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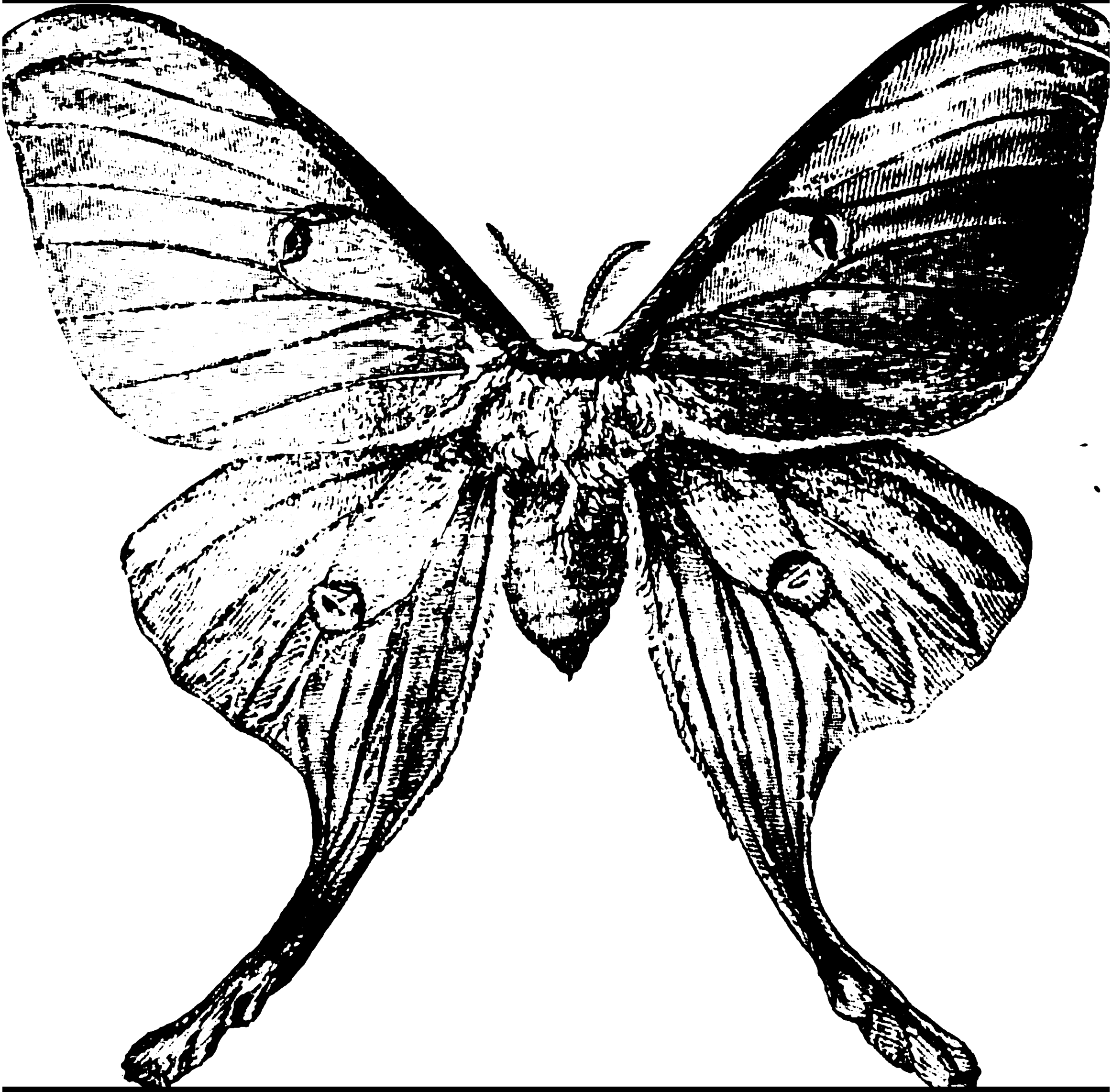

Annual Report - Entomological Society of Ontario

Entomological Society of
Ontario, Ontario. Dept. of Agriculture

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ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

FOR THE YEAR 1877.

INCLUDING REPORTS ON SOME OF THE NOXIOUS, BENEFICIAL AND OTHER INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, ON BEHALF OF THE SOCIETY,

BY

WILLIAM SAUNDERS,

President of the Entomological Society of Ontario; Editor of Canadian Entomologist.

REV. C. J. S. BETHUNE, M. A.,

Head Master of Trinity College School, Port Hope.

B. GOTT,

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REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE YEAR 1877.

To the Honourable the Commissioner of Agriculture:

SIR,—In accordance with the provisions of our statute of incorporation, I have the honour to submit for your consideration the Report of the Entomological Society of Ontario, for the year 1877, in which you will find a detailed statement of the receipts and disbursements of the year, all of which are duly audited.

The annual meeting of the Society was held at the City of London, during the time of the exhibition of the Agriculture and Arts Association, when the various reports were read and the officers elected for the ensuing year.

The *Canadian Entomologist*, our monthly organ, appears regularly, and fully maintains its high standing. Its pages during the past year, have been enriched by many articles of the highest practical importance from leading entomologists. The numerous learned and original investigations and discoveries in Entomological science, which have been announced in the pages of the *Canadian Entomologist* have gained for it a high reputation in foreign countries, as is shown by the largely increased list of exchanges.

I have also the pleasure in submitting a Report on some of the noxious, beneficial and other insects of this Province, prepared on behalf of the Society by Mr. William Saunders, Rev. C. J. S. Bethune, M.A., B. Gott, and myself. This Report is well supplied with illustrations of the insects described, and will, we believe, prove valuable and interesting.

I have the honour to remain, sir,
Your obedient servant,
JOSEPH WILLIAMS,
Secretary-Treasurer of the Entomological Society of Ontario.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The seventh annual meeting of the Entomological Society of Ontario, was held in London, at the rooms of the Society, on Wednesday evening, September 26th.

The President, W. Saunders, in the chair.

Present :—D. W. Beadle, St. Catharines ; Professor Buckland, Toronto ; P. C. Dempsey Albury, B. Gott, Arkona ; Rev. R. Burnet, London ; Chas. Arnold, Paris ; David Boyle, Elora ; Colonel McGill, Oshawa ; E. B. Reed, London ; J. M. Denton. London ; Charles Chapman, London ; A. Puddicombe, London, and others.

After calling the meeting to order, the President expressed his regret that the Society had during the year lost the valued services of one of its officers. Owing to pressing business engagements, the Secretary-Treasurer, Mr. J. H. McMechan, had found it necesary to resign. Pending the appointment of a successor, Mr. J. Williams had kindly consented to act as Secretary *pro tem.*, and in this capacity had rendered most valuable and timely assistance.

The report of the Treasurer showed a very satisfactory state of the finances, there being a balance to the credit of the Society at the close of the financial year of two hundred and thirty-six dollars.

FINANCIAL STATEMENT OF THE SECRETARY TREASURER.

Receipts.

To Balance from 1876	$185 60
" Members' fees	194 55
" Sales of cork, pins, labels, &c	101 17
" Government Grant	750 00
	$1,231 32

Disbursements.

By CANADIAN ENTOMOLOGIST, printing, &c	347 75
" Paper for	102 76
" Printing labels	11 75
" Mail list and stamping	13 50
" Travelling expenses to Annual Meeting	6 00
" Sundry small expenses	50 70
" Postage, express and duties	46 82
" Library	77 52
" Engravings	20 04
" Merchandise, pins and cork	89 00
" Insurance	10 63
" Editor's salary	100 00
" Secretary-Treasurer's salary	50 00
" Expenses of Annual Report	68 00
" Balance	236 85
	1,231 32

We certify the above as a correct statement of accounts for the year ending September 26th 1877, as shown by the Treasurer's books, and with vouchers for the same.

JOHN M. DENTON,
CHARLES CHAPMAN. } *Auditors.*

REPORT OF THE COUNCIL, 1877.

In presenting the seventh annual report, the Council feel highly gratified at the success that has attended the labours of the Society during the past year.

We are happy to note the return of the Society's Centennial collection of insects, which reached London in good condition shortly after the close of the International Exhibition. This collection, which was noticed in your last annual report, is now placed in the Rooms, where it will in future be available for reference. As this beautiful collection was made up largely from the cabinets of individual members of the Society, who generously loaned the insects for the purpose of exhibition, it was thought that if the immediate return of the loaned specimens was insisted on, the value of the series would be greatly impaired; but we are happy to state that the parties concerned have in most cases given their consent to allow the specimens to remain on deposit in the Society's Rooms, so that we still retain the Centennial Collection of Canadian Insects almost intact, a monument to the zeal and industry of those members of the Society who were actively engaged in this work.

We may add that this collection was placed on exhibition at the Rooms on several occasions after its return, when some of the members were present to assist visitors, and from the interest manifested then by the public in the matter, we would recommend that the Rooms be thrown open occasionally to all who may desire to visit them, and that public notice be given of the same

The CANADIAN ENTOMOLOGIST has almost completed its ninth volume, and fully maintains its reputation as a record of the latest investigations and discoveries in scientific and practical Entomology. We would return our heartiest thanks to all those who have so kindly contributed to the pages of the ENTOMOLOGIST, and request that they will continue to favour the Editor with the results of their observations and experiments. Although we have reason to feel gratified at the efforts of the Society to excite in the general public an interest in Entomology, yet we would respectfully suggest that our successors may be able in some measure to improve on the means adopted in the past to render the ENTOMOLOGIST even more useful to beginners in this interesting science, either by more frequent descriptions and illustrations of our common insects, and perhaps by referring to the insects that are likely to appear in each month of the summer, and the manner of their capture and preservation, or in any other method that may appear suitable.

We are happy to note a steady increase in the number of members. The Branch Societies, especially in London and Montreal, are progressing favourably.

The funds of the Society are in a gratifying state ; by economical management we have been enabled to sustain and successfully carry out all the operations we have undertaken ; for details we refer to the report of the Secretary-Treasurer.

The Library has been enriched by a number of valuable scientific works, and others of more general interest, but which bear on Entomological subjects. Among the additions we may mention the *Encyclopedia Britannica*, as far as at present published, which will prove invaluable as a means of reference. Our stock o engravings and electrotypes has been slightly increased, but in this line we are greatly restricted by want of means, and are obliged generally to content ourselves with electrotypes of other illustrations. We believe that a much larger sum than is annually given for this purpose might be profitably expended in procuring original illustrations.

Submitted on behalf of the Council by

JOSEPH WILLIAMS,
Secretary-Treasurer.

The President read his annual address, which received a vote of thanks. Rev. R. Burnet, in seconding the motion of vote of thanks, took occasion to speak highly of the value of the labours of Mr. Saunders, and suggested that his address appear in the daily papers as well as in the Annual Report, which was approved of.

ANNUAL ADDRESS OF PRESIDENT.

GENTLEMEN,—At the close of another year it is my duty and privilege to offer you a few remarks relating to our progress as a Society, and also to the general advancement of that department of natural science in which we all feel so deep an interest.

The progress of the Entomological Society of Ontario during the past year has been steady and continuous. Every season witnesses an infusion of new blood into our ranks, mainly from among the young, who, when entering on the pursuit of this charming study, bring with them all the enthusiasm and ardour of youth. Our membership is thus gradually increasing, and our influence and sphere of usefulness yearly extending. The importance of the study of Entomology is gradually becoming more deeply impressed upon the public mind. The Entomologist needs no longer to apologize for the trivial character of his pursuits, for small and apparently insignificant as the operations of the individual destructive insect may appear, yet when multiplied, as they usually are, by millions, their work is so disastrous and so desolating that the study of their life and history, with the view of combatting more effectually their enormous increase, becomes of the most vital importance.

We have to note the prevalence during the past year of several insect pests. Early in June our gardens, orchards, and even our forests in the western portion of Ontario were frightfully devastated with the Forest Tent Caterpillar, *Clisiocampa sylvatica*. There were millions upon millions of them, and so enormous were their numbers, and so persistent their attacks, that after fighting them bravely for a week or two, many gave up the contest in despair, weary of the slaughter. Many an orchard was rendered bare and leafless, and in some instances the woods were so void of foliage as to remind one of winter. This was particularly the case about London, and our orchards and gardens here were saved from destruction only by the most persistent effort. For several weeks caterpillars were swarming everywhere, so that the timid scarcely dared venture out under the shade of trees for fear of bringing them home on their clothing or persons. By the end of June they had nearly all become chrysalids, and it was interesting to observe the strange looking deformities they occasioned among ornamental shrubs and flowers by twisting the leaves into suitable forms in which to enclose their cocoons. On the trees the few fragments of leaves remaining were put to a similar purpose, and thus sewed up and hanging pendant with the weight of sometimes two or three cocoons huddled together, they looked very odd.

On examining a number of these chrysalids, a large proportion of them were found to be infested with parasites, which materially lessens the chances of their being so very numerous again next year; still we fear that enough of them passed safely through all their preparatory stages to give us some trouble another season.

The Cabbage Butterfly, *Pieris rapæ*, is still progressing westward. This year it has extended its domain as far as Chicago, where a few of the advance guard have been captured. In the neighbourhood of London their larvæ have been very destructive this summer, so disfiguring and destroying the cabbages in many instances as to render them entirely worthless. The history of the introduction of this pretty little pest forms an interesting chapter in our Entomological annals. During the time of the Trent difficulty in 1861, a quantity of fresh vegetables were sent along with other stores to Quebec for the sustenance of the gallant little army which was despatched to our shores. As the Cabbage Butterfly is said to have made its appearance shortly after this period, it is presumed that it was accidentally introduced with the stores for the troops. In 1863 specimens were sent to us from this district for determination, which was the first intimation we had of their existence in this country. By 1866 the butterfly had spread further west than Montreal, and east as far as the Saguenay River. In 1869 it was reported as common in New Jersey, and by 1871 it had travelled east as far as Halifax, Nova Scotia, and west to the middle of the State of New York It now embraces an area bounded by the shores of the Atlantic from the River St. Lawrence to Virginia, and has overrun the whole country westward as far as Chicago. A few days since, while on a visit to the Muskoka District, I was surprised to find them plentiful, in company with the Colorado Potato Beetle, as far north as the head of Lake Rosseau.

The wonderful manner in which this insect has adapted itself to the varying climatic characteristics embraced within this wide area, is a matter of astonishment. It seems to thrive alike in the cold north and sunny south, and in every place where it established itself it has multiplied so rapidly as to become in a very short time the commonest of all butterflies. The little parasite, *Pteromalus puparum*, which has also fortunately been introduced from Europe, and which is finally destined to keep this pest within reasonable bounds, is on the increase here, but is not yet sufficiently numerous to fulfil its mission as successfully as we could wish.

The Colorado Potato Beetle, as predicted, has at last found its way across the Atlantic, and founded colonies on the Continent and in the British Isles. Their arrival and settlement has caused a commotion almost as great as would the approach of a hostile army. According to newspaper accounts, large patches of ground where the enemy has been seen lurking have been saturated with benzine and fired, while in the search, the whole surface has been turned over with the spade and shovel as carefully as if each specimen were a nugget of gold or a diamond. Cargoes of all sorts in which it was suspected the intruders could find a hiding place have been submitted to the most rigid examination by government officials, and various edicts were promulgated, with a view to strangle this evil in its infancy; but the beetle is heedless of enactments, however prohibitory, and we fear that no vigilance, no matter how persistent, will prevail in preventing the spread of this little intruder, and that before long the potato grower in Europe will be obliged to regularly adopt measures for poisoning this pest similar to those so successfully carried out by our own people.

Since I was last privileged to address you, the Congress of the United States, in view of the enormous losses yearly inflicted on agriculture by destructive insects, have appointed an Entomological Commission composed of eminent Entomologists, who shall devote their whole time for several years to a study of the habits of the various insect pests, and the thorough testing of the efficiency of such remedies as have been or may be devised for their destruction, and to report progress from time to time. A liberal appropriation to defray the expense of this work has been made, and the labourers are now actively engaged in the field.

Early in the year, your President was requested by the Chief of this Commission, Prof. C. V. Riley, to bring this important matter before our Government and ask their influence towards furthering the objects in view. Accordingly, at a meeting of the Council of Agriculture, held in June last, the writer introduced a resolution urging the co-operation of our Government with that of the United States in this undertaking, which was unanimously adopted by the Board and transmitted to the proper authorities. I am pleased to be able to state that the Minister of Agriculture, in his reply, assured us that this subject had already engaged their serious attention, and that every effort would be made to aid the Commission in its work. This season is being spent by these savans in especially studying the habits and breeding places of the destructive Locusts of the West, and already they have made extended observations, not only in the western territories of the United States, but also in some of the adjoining portions of our Dominion.

The Entomological Club of the American Association for the Advancement of Science held its annual meeting in Nashville, Tenn., commencing on the 30th of August, when many interesting subjects were discussed. An important paper was read by A. R. Grote, Esq., of Buffalo, N. Y., on a new insect, destructive to the red and white pine trees, the sources of our valuable lumber trade. From the details given of the work of this insect we fear it may prove a formidable foe to the future growth of our pine forests. Our Society has usually been represented at these annual gatherings, but on this occasion, owing to other pressing and unavoidable engagements, those of us who have usually attended were prevented from being present.

We cannot better illustrate the recent progress made in Entomological science than by referring to one department, namely, that of the study of our night-flying moths. This has been greatly stimulated by the general practice of sugaring, by which immense numbers of these insects have been attracted, and their capture in good condition made an easy matter. This practice in America was but little followed until 1874, when an English Entomologist, Mr. George Norman, visited Canada, and, after having faithfully carried out the process of sugaring for a season, he published the result of his labours and his mode of operating, in our journal. His success was so unprecedented, and so many rare, or hitherto unknown species captured, that collectors everywhere were induced to imitate his example, and in the short time that has since elapsed an immense number has been added to the list of known species, and our collections have been enriched by this means with an extensive series of hitherto rare specimens.

Our monthly journal, the CANADIAN ENTOMOLOGIST, is still well sustained, its pages being regularly filled with interesting and original contributions. Did time permit, I might have occupied your attention at considerable length by referring to the many valuable points brought out in these papers. I cannot, however, refrain from adverting to the contributions of Mr. W. H. Edwards, of West Virginia, on the life history of some of our butterflies, in which it has been shown that not a few of our so-called species are merely dimorphic forms of other species, and attention drawn to the important influence of cold in modifying these forms. By exposing the chrysalids to the influence of this agency by laying them for varying periods on ice, or placing them in an ice house, some of these dimorphic forms have been produced at will, thus throwing much light on the causes of variation in species.

I would also call your attention to the many recent valuable additions to Entomological literature in America, especially to the beautifully illustrated work of Dr. A. S. Parkard, on the Geometrids of North America; to the continuation of Edwards' magnificent work on North American Butterflies; to the learned and elaborate treatise on the Rhyncophora of America north of Mexico, by Drs. LeConte and Horn; to the excellent works of Prof. Townend Glover, of Washington, on American Diptera, Orthoptera, and Hemiptera; to the valuable reports of the State Entomologist of Missouri, and many other excellent works. But I must not trespass longer on your patience. Thanking you for your kind partiality in honouring me as you have done,

I have the honour to be,
Yours very sincerely,
WM. SAUNDERS.

London, Ontario, September 25th, 1877.

The election of officers then took place, with the following results:—

President.—W. Saunders, London.
Vice-President.—E. Baynes Reed, London.
Secretary-Treasurer.—J. Williams, London.
Council.—Wm. Couper, Montreal; Rev. C. J. S. Bethune, Port Hope; J. Pettit,

Grimsby; J. M. Denton, London; Rev. R. Burnet, London; R. V. Rogers, Kingston; Ja. Fletcher, Ottawa.

Editor of Canadian Entomologist.—W. Saunders, London.

Editing Committee.—Rev. C. J. S. Bethune, Port Hope; E. B. Reed, London; and G. J. Bowles, Montreal.

Library Committee.—The President, Vice-President, Secretary-Treasurer, and J. M. Denton.

Auditors.—Chas. Chapman and A. Puddicombe, of London.

During the time allotted for miscellaneous business, Mr. D. W. Beadle, of St. Catharines, spoke of the ravages of the Cabbage Butterfly, *Pieris rapœ*, and of the great benefit that would be conferred on gardeners by the discovery of some remedy which might be safely used for this pest. He also referred at length to the great success which had attended the labours of the Entomological Society, and of the high reputation it had acquired in America and foreign countries.

The President, in reply, referred to the rapid increase of the small parasite Pteromalus puparum, which preys on this species, and the gratifying prospect of a speedy diminution n numbers of the cabbage butterfly from this cause.

Mr. P. C. Dempsey, of Albury, stated that hot water had been successfully used in his neighbourhood to destroy the *Pieris* larva; that experiment had shown that the cabbage would bear the application of water heated to 200° Fahrenheit, without injury, while water at a somewhat lower temperature than this would effectually destroy the larva. The hot water may be applied through a rose sprinkler, or by the use of a dipper. He also stated that a cold infusion of Quassia, in the proportion of two or three pounds to a barrel of water, had been found effectual in destroying the worm, and more convenient in its application than hot water. This solution may give a slightly bitter taste to the vegetable, unless thoroughly washed, but it is perfectly harmless to the human system.

Mr. Chas. Arnold, of Paris, referred to the increasing ravages of the Codling worm (*Carpocapsa pomonella*), and stated that he had scarcely a sound apple in his orchard this year. This was, doubtless, partially due to the small crop, and he hoped that the scarcity of apples this season would so far starve out this insect that we might enjoy some immunity from its attacks for a year or two.

Rev. Dr. Burnet, President of the Fruit Growers' Association, expressed his pleasure at being present, and his high appreciation of the labours of the active members of the Society, and referred to the great benefits which fruit growers had derived from the publication of the results of their investigations on noxious insects injurious to fruits.

Prof. Buckland, of the Department of Agriculture, Toronto, spoke of the great utility of the work carried on by the Society in diffusing information in reference to the various insect pests which afflict the farmer and fruit grower, and of the flattering notices he had seen in foreign journals concerning the CANADIAN ENTOMOLOGIST. He believed the Society well deserved the cordial support of all those interested in agriculture.

The President, in confirmation of these remarks, alluded to the fact that the CANADIAN ENTOMOLOGIST numbers on its exchange list many periodicals of the highest standing, English, American, French and German.

ANNUAL MEETING OF THE LONDON BRANCH

The Annual Meeting of the London Branch of the Entomological Society of Ontario, was held on January 23rd, 1877, at the rooms of the Society.

The following officers were elected for the year 1877:—

President.—Chas. Chapman.

Vice-President.—J. M. Denton.

Secretary-Treasurer.—J. Williams.

Curator.—A. Puddicombe.

Council. —Messrs. H. P. Bock, W. Saunders, and J. Williams.

The Annual Report of the Secretary-Treasurer was read and adopted; it showed that a small balance remained after all expenses had been met.

REPORT OF THE COUNCIL.

The Council of the London Branch of the Entomological Society of Ontario, beg to submit the following:—

The prospects of the Branch are very good; the meetings have been well attended, excepting during the heat of the summer, and many valuable additions have been made to our collections.

The experiment of placing the Centennial Collection on exhibition at the rooms was so favourably received by the public, that it has been decided to take steps to the more frequent admittance of non-members, and in this way it is hoped and believed something may be done to create a wider and deeper interest in our favourite branch of science. This is a matter of great importance, and we have no doubt our members will acquit themselves creditably in it.

Submitted on behalf of the Council, by

JOSEPH WILLIAMS,
Secretary-Treasurer.

MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Fourth Annual General Meeting of this Branch was held on Tuesday, 1st of May at 8 o'clock p.m., at the residence of H. H. Lyman, Esq., the President, in the chair.

The following report was read and adopted:

REPORT.

Your Council beg to present the Fourth Annual Report of the Society's operations.

They would refer with pleasure to the satisfactory progress of the Society in the study of our science, evinced by the steadiness with which the monthly meetings have been kept up, and the interesting and valuable papers read at these meetings. Solid progress has been made in the identification and classification of the insects of Montreal, and much preliminary work has been accomplished, the value of which will appear hereafter. The only cause for regret is that our number continues so small, but the zeal and perseverence of the present members go far to compensate for their paucity in number. Your Council entertain the hope that at no distant day our membership will be augmented by the addition of at least a few more students of our useful and interesting branch of natural history.

Twelve meetings were held during this year, at which the following papers were read and presented to the Society:

G. J. Bowles—"List of Eggs and Larvæ Described in the Seven Volumes of the CANADIAN ENTOMOLOGIST."

H. H. Lyman—"Notes on the Occurrence of *Argynnis idalia.*"

F. B. Caulfield—"List of the Geometridæ of Montreal."

W. Couper—"On *Phyciodes tharos.*"

H. H. Lyman—"List of some of the Geometridæ of Montreal."

F. B. Caulfield—"Notes on some Species of *Chrysomelidæ* Occurring on the Island of Montreal."

F. B. Caulfield—"Notes on the Species of *Meloe* in Canada."

H. H. Lyman—"Entomological Rambles, Including Notes on Entomology at the Centennial Exhibition."

G. J. Bowles—"The Noctuidæ of Quebec."

G. J. Bowles—"Notes on D'Urban's Paper in the *Canadian Naturalist*, Vol. v., with Identifications of the Species."

Some progress has been made during the year in the compilation of the "Montreal Catalogue," and the names of 790 identified species are now entered on the list, comprising 385 Lepidoptera, 367 Coleoptera, 4 Diptera, 15 Orthoptera, 16 Hymenoptera and 3 Hemiptera. The earnest co-operation of the members is requested by your Council in this work. There is no doubt but that it will be of immense value to future students and will form a lasting memorial of our labours.

The finances of the Society have engaged the earnest attention of your Council. They would recommend that the cash on hand be expended in books for our Library, under the direction of the new Council.

The whole respectfully submitted.

Geo. Jno. Bowles,
President.

Montreal, 1st May, 1877.

The following were then elected to office for the ensuing year:

G. J. Bowles, President, (re-elected); H. H. Lyman, Vice-President; G. B. Pearson, jr., Secretary and Treasurer (re-elected); C. W. Pearson Curator (re-elected); Council—F. B. Caulfield, Robert Jack, W. Hibbins, jr.

After a pleasant conversation on Entomological subjects, and the examination of numerous specimens, the meeting adjourned.

G. B. Pearson, Jun.,
Secretary.

EXPERIMENTS ON THE COLORADO POTATO BEETLE.

By W. Brodie, Toronto.

The following interesting paper giving details of experiments on the Potato Beetle was read at a recent meeting of the Toronto Entomological Society:—

Gentlemen,—I herewith submit for your consideration a synopsis of a series of experiments, conducted by myself, intended to determine certain facts in the life-history of *Doryphora* 10 *lineata*, about which there is a good deal of popular misconception.

The experiments were made in cages, where the natural conditions of temperature, light, and moisture were maintained as nearly as possible; the same cages in which I had successfully reared larvæ of *Papilio trolius* and other delicate lepidoptera.

To secure greater accuracy nearly every experiment was repeated, or two or more conducted simultaneously, and the results carefully compared and recorded.

The more important propositions supported by these experiments are:

First.—The potato is the only plant in Ontario on which the beetle can feed so as to become very numerous.

Second.—Food is necessary to the imago, in order to develope the reproductive functions.

Third.—If not supplied with food the imago will die in a short time—perhaps never exceeding two weeks.

Fourth.—The advent in Toronto of *Lydella doryphora*, by far the most reliable and valuable of all the enemies of *D.* 10 *lineata.*

It is so generally conceded that *D.* 10 *lineata* will not feed on the leaves of any of our forest trees neither on any of our grasses, nor cyperaceous plants; that proofs of this need not be submitted nor discussed. The plants experimented upon, you will see, are mainly those which have been named as food plants by newspaper men, farmers and others.

Experiment 1.—Thirty mature beetles, after being kept without food for twenty-four hours, were supplied with leaves of carrot, parsnip, beet, pumpkin, lettuce, sunflower, sage, *Panicum crus galli*, and cabbage, for eight hours; none eaten; when supplied with potato leaves, all ate freely.

Experiment 2.—Thirty mature beetles, after being kept without food for thirty-two hours, were supplied for sixteen hours,—in addition to the plants named in experiment 1.—with red root, (*Amarantus hybridus*), sheepbur, (*Cynoglossum officinale*), burdock, (*Lappa officinalis*), small bur, (*Echinospermum lappula*), sour dock, (*Rumex crispus*), *Lobelia syphilitica* and *L. inflata*, lambs quarter, (*Chenopodium album*), mullein, (*Verbascum thapsus*); none eaten; when supplied with potato leaves all ate freely. This experiment was also repeated three times, with uniform result.

Experiment 3.—Thirty mature beetles, after being kept eleven days without food, were, in addition to the plants used in the second experiment, supplied with leaves of milk weed (*Asclepias cornuti*), arrow head (*Saggittaria variabilis*), Canada thistle (*Cirsium avvense*) water parsnip (*Sium lineare*), golden rod (*Solidago nemoralis*), fleabane (*Erigeron Canadense*), cat mint (*Nepeta Cataria*), common plantain, (*Plantago major*), *Apocynum androsœmifolium.* None were eaten. When supplied with potato leaves, all ate freely.. This experiment was repeated three times with unvarying results.

The solanceous plants found in Ontario, outside of cultivation, on which it is generally admitted Doryphora will feed are the *Hyoscyamus niger*, *Physalis viscosa*, *Nicandra physaloides*, *Solanum niyrum*, *Solanum dulcamara*, *Datura stramonium.* It is very doubtful if Doryphora, either in the lavræ or imago state, will feed on the last two named. They are, however, all late plants, and would afford no food in the spring season, and so scarce that they would not feed the July brood for one hour.

Experiment 4.—Aug. 8. Took in fifty mature D. 10 lineata larvæ, forty-five of which had changed to beetles on Aug. 26, while five had died in the pupating stage. These forty-five beetles were kept without food; four died on the fourth day, thirty-seven were dead on the fifth day, thirty-nine on the eighth day, forty-two on the tenth day, forty-five on the eleventh day. Over 75 per cent. died within five days, the males dying first. No pairing took place, no ova were deposited, and no disposition to hybernate was evinced.. This is the average of three cases conducted simultaneously, and which varied but little.

Experiment 5.—Aug. 8. Took in thirty mature beetles all of which had partaken of food, and kept them without food. Two were dead in fourteen days; eight in nineteen days; thirteen in twenty-three days; sixteen in twenty-seven days; twenty-four in forty-seven days. Twenty per cent. survived forty-seven days' fasting; pairing occurred, and ova were deposited to a small extent during the first ten days. This is the average of three cases conducted simultaneously.

There is a very marked difference between this result and that of Experiment 4, where the beetles had never partaken of food.

Experiment 6.—Aug. 15. Twenty pairs *Doryphora,* after being well fed were kept in a dry situation; thirty two were dead in twelve days; all dead in twenty-two days; the males died first; a few ova were deposited during the first week. This experiment was repeated three times.

Experiment 7.—As to the rate of feeding, five experiments were tried. The beetles numbered fourteen to twenty-one, and the times from 3½ to 168 hours; the average of the five trials was, one beetle will eat one square inch of potato leaves in thirty hours; the maximum rate was ten hours, minimum was thirty-seven hours. It may be stated that one beetle during its imago life will defoliate one plant of potatoes.

Experiment 8.—Aug. 20. Took in fifty beetles which had been well fed; eleven immediately buried themselves in the sand. September 6. All dead above ground; turned out the sand and found the eleven alive; replaced sand, also beetles; eight at once buried themselves. September 15. Three remaining on surface dead. September 20. Found all on surface of sand, which I found quite dry; on wetting sand all went down, are now alive October 16.

Experiment 9.—September 1. Took 100 *Doryphora* larvæ, some immature, fed them on potato. Sept. 10, all pupating. Sept. 20, 15 beetles out. Oct. 1, beetles all dead. On turning out the sand found that none had hybernated. This agrees with the results of seven experiments, and shows that there was no disposition to hybernate until after the middle of August, and then only by beetles which had fed.

The date of hybernation will vary according as the season is warm or cold, but I think it pretty certain that beetles which have not fed will not survive the winter.

A result of experiment 4 was the finding of a pupa case of *Lydella doryphora* under conditions which were fully narrated to you at our September meeting, and which you all agreed were conclusive as to the advent of this farmers's friend in Toronto.

It is hoped the publication of this will elicit evidence of its occurrence in other counties in Ontario, but it must be borne in mind that the very general use of Paris green by potato growers, has hitherto prevented the increase of this as well as other natural enemies of D. 10 lineata; has, in fact, rendered their existence almost impossible.

PROCEEDINGS OF THE ENTOMOLOGICAL CLUB OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Room 56, Maxwell House, NASHVILLE, TENN., Aug. 31, 1877.

Mr. Grote was called to the chair, and congratulated the meeting that there were found members from the South interested in the science of Entomology, and regretted the absence of the President of the Club and other officers. A letter was read from President LeConte as follows:

PHILADELPHIA, AUG. 24TH, 1877.

Secretary of the Entom. Club Am. Assoc. Adv. Sci. Nashville, Tenn.:

DEAR SIR,—I beg that you will express to the Entomological Club of the Association my great regret that I am not able to attend the meeting at Nashville. It was my intention to be present, but I find now at the last moment that it will be extremely inconvenient for me to leave this city. I greatly wished to take part in the discussion on nomenclature, but I have already expressed myself so strongly as against such changes as are produced by the rehabilitation of forgotten or disused names, that I think my opinions are fully understood by my colleagues.

Very truly yours,
JOHN L. LECONTE.

The Secretary's report of last year's meeting was received and adopted.

The chair drew the attention of the Club to the report of Capt. Dall on the subject of Zoological Nomenclature made at this meeting, and deprecated any separate action on the part of the Club.

The following resolutions were then passed:

Resolved—That since the Association has under consideration the subject of Nomenclature, the present Committee of the Club on that subject, consisting of LeConte, Riley, Saunders, Scudder and Grote, be continued to report at next meeting.

Resolved—That a request be made on the part of the Club to the Standing Committee of the Association, that copies of Capt. Dall's report on Zoological Nomenclature be printed and distributed to all active members of the Club before the issuance of the Nashville volume, so that the matter may be duly considered before the next meeting of the Club.

The meeting then entered into an election for officers for the next meeting, with the following result:

President: James A. Linter, of Albany, N. Y.
Vice-President: Wm. Saunders, of London, Ontario.
Secretary: B. Pickman Mann, of Cambridge, Mass.

Mr. Grote exhibited specimens in all stages of the New Pine Moth, *Nephopteryx Zimmermani.* He referred to Mr. Meehan's remarks after the reading of the paper before the Association on Thursday last, that this was probably the insect so destructive to the Scotch Pine about Philadelphia.

Prof. Nicholson stated that he thought from Mr. Grote's description and specimens that this insect was the one noticed as attacking the Scotch Pine near Knoxville. The trees had been imported from the north.

Mr. Grote alluded to the migratory habits of the Cotton Worm, and stated that in his original paper (Hartford Meeting) he had shown that the moth hybernated, but died before it could find cotton on which it could oviposit the ensuing year. Where the moth state was not reached the chrysalis perished in cold winters over the cotton belt. The broods were irregular, occurring in the same locality some years as early as June, some years as late as September.

Prof. Stubbs stated that in the main Mr. Grote's theory of a progression from south to north was, he was satisfied, correct. At the same time he called attention to occasions where the moth appeared in small areas, and thought it possible that in some cases the insect might succeed in holding over.

Mr. Grote stated that he thought that in localities where the circumstances were favourable, Southern Florida and along the coast of Georgia, that this might occur. He had in his original paper alluded to this, and he thought it more likely that the irregular patches on the cotton belt were partial colonizations from the southward or from the sea coast of Florida or Georgia. The first brood was more irregular in distribution. He further said that Prof. Tutwiler, of Ala., had told him that the observations made in his locality were to the effect that the south wind brought the worm; in the present year the prevailing winds were from the north and they had been free rom the worm in Northern Alabama. Mr. Grote concluded by urging the creation of a scientific commission to look into the facts of the case. It was one that was most important to the agricultural interests of the South.

Prof. Nicholson stated that he had observed a few specimens of the Colorado Beetle near Knoxville; the seed had been brought from the north.

Judge Bell stated that this year he had seen the Potato Beetle at Exeter, New Hampshire.

Mr. Grote exhibited some rare Celeoptera collected at Buffalo, N. Y., by Mr. Ottomar Reinecke. Adjourned.

(Signed) A. G. WETHERBY,
Secretary, pro. tem.

A NEW LEPIDOPTEROUS INSECT

INJURIOUS TO VEGETATION.

BY A. R. GROTE, BUFFALO, N. Y.

(*Read before the Am. Asso. Adv. Sci., August* 30, 1877.)

In the months of June and July the Red Pine (*Pinus resinosa*) and the White Pine (*Pinus Strobus*), show by the exuding pitch that they are suffering from the attacks of an insect. The wounds occur on the main stem below the insertion of the branch. On cutting into the bark the injury is found to be caused by a small larva, which, when full grown, measures 16 to 18 millimetres. The head is shining chestnut brown with black mandibles. The body is livid or blackish green, naked, with series of black dots, each dot giving rise to a single, rather stout, bristle, The prothoracic shield is blackish. The larva has three pair of thoracic or true jointed feet, and four abdominal or false feet, besides anal claspers. This larva, eating on the inner side of the bark, and making furrows in the wood, causes the bleeding which, when the depletion is excessive or continuous, and especially in the case of young trees, has proved fatal.

In July the worm spins a whitish, thin, papery cocoon in the mass of exuding pitch, which seems to act as a protection to both the larva and the chrysalis. The chrysalis contained in the cocoon is cylindrical, smooth, narrow, blackish-brown, about 16 millimetres in length. The head is pointed, there being a pronounced clypeal protuberance ; the segments are unarmed ; the anal plate is provided with a row of four spines, and two others, more slender, on either side of the mesial line, below the first. It gives the moth in ten to fourteen days. The perfect insect expands on an average 30 millimetres. An examination of the veins of the wing show that vein 7 of the primaries is wanting, while vein 1 is simple. On the hind wing the cell is closed or very nearly so. It belongs thus to the *Phycidæ*, a subfamily of the *Pyralidae*. The male antennæ are bent a little at the base, the joints inconspicuous; the maxillary palpi in the same sex are not brush-like, and the hind wings are 8 and not 7 veined. We may refer the moth, then, to the genus *Nephopteryx*. Veins 3, 4 and 5 spring nearly together from the outer extremity of cell of the hind wings (though 5 seems to be nearly independent while running close to 4) ; vein 2 is not far removed from 3. On the primaries veins 4 and 5 spring from a common stalk, so that we must refer the moth to the sub-genus *Dioryctria* of Zeller. In colour the moth is blackish gray, shaded with reddish on the basal and terminal fields of the fore wings, There are patches or lines of *raised* scales on the basal field and on the anterior and darker portion of the medium space. The median lines are prominent, consisting of double black lines enclosing pale bands. The inner line at basal third is perpendicular, W-shaped or dentate. The outer line at apical fourth is once more strongly indented below costa. The black component lines do not seem to be more distinct on one side than on the other of the pale included bands or spaces. The median field is blackish, becoming pale towards the outer line, it shows a pale, sometimes whitish cellular spot, surmounted with raised scales. It can be seen that these raised scales (easily lost in setting the insect) accompany the median lines as well as forming the discal mark and the linear patch on the basal field. The terminal edge of the wing is again pale or ruddy before the terminal black line. The fringes are blackish. The hind wings are pale yellowish white, shaded with fuscous on costal region and more or less terminally before the blackish terminal black line ; the fringes are dusky. Beneath the fore wings are blackish, marked with pale on costa ; hind wings as on upper surface. Body blackish gray, with often a reddish cast on thorax above and on the vertex. The eyes are naked, the labial palpi long, ascending with moderate terminal joint. Tongue rather long. The gray abdomen is annulated with dirty white, the legs are pale dotted. The species differ from the European *abietella* by the raised scale tufts on the wings, and Prof. P. C. Zeller, who has kindly compared examples for me, declares it to be quite distinct from any European species. The pupa seems to differ from that of *abietella* by the clypeal prominence, which appears entirely absent in the European species, judging from Ratzburg's excellent figures. The larvæ is found to attack also various imported conifers; for this reason I supposed it might be an imported parasite. It has been noticed on the Scotch, Austrian and Russian Pine, and it will be found, I fear, a grave enemy to the cultivation of this genus of trees.

Since the insect is not noticed yet in any scientific publication, I propose to name it *Nephopteryx (Dioryctria) Zimmermani*, after Charles D. Zimmerman, of Buffalo, who has made many excellent observations on our noxious insects, and to whom I am greatly indebted for help in getting the present facts with relation to the species. He has kindly spent much time in climbing large trees and cutting out pupæ and larvæ and rearing the perfect insect.

The larvæ *abietella* is described by Ratzburg as living in the cones chiefly of various species of *Pinus*. Nevertheless he speaks of one instance in which it is found under similar circumstances to those which are usual with *Zimmermani*, which latter I have not yet noticed attacking the fruit. The European species is said to winter in pupa state. In the vicinity of Buffalo our species seems to be single brooded. I have not yet ascertained the winter state. Ratzburg recommends cutting off infested branches, but especially on small trees. I find the larvæ of *Zimmermani* usually infesting the *main* stem at the insertion of the branches. From the fact that the pitch of the trees offers a protection, I do not think that any washes would reach the insect. The knife, then, seems the only remedy.

Our species has a natural enemy in a small hymenopterous parasite with which I have found certain of the chrysalids to be filled.

THE UNITED STATES ENTOMOLOGICAL COMMISSION.

The enormous losses occurring yearly to agriculture in America from destructive insects are gradually awakening public attention in this direction, and also to the necessity of careful observations on the habits of these pests, with a view to their destruction or limitation. We were much gratified to learn that the late Congress of the United States, recognizing the importance of this subject, made a liberal appropriation to provide for the appointment of a commission of practical Entomologists to investigate and study the habits and life history of these insect pests, and thoroughly test such measures as have been or may be suggested with a view of lessening their ravages, the investigations to be carried on for several consecutive years. The Government has been particularly fortunate in securing the services of three eminently practical Entomologists to undertake this work, Prof. Riley, State Entomologist of Missouri, Dr. A. S. Packard, of Salem, Mass., and Prof. Thomas, State Entomoligist of Illinois. Prof. Riley has been designated Chief; Dr. Packard, Secretary, and Prof. Thomas, disbursing agent. While the destructive Rocky Mountain Locust, *Caloptenus spretus*, will specially engage the attention of the Commission during this year, careful observations will at the same time be made on other destructive pests. We desire to call particular attention to Dr. Packard's request in this present issue, for specimens in all stages of the Hessian Fly, Joint Worm and Wheat Midge, and trust that all our members will endeavour to aid the Commission in their labours in every possible way.

The headquarters of the Commission will be at St. Louis, Mo.; there will also be an office, with a clerk to attend to certain routine business, at the rooms of the Geological and Geographical Survey of the Territories, at Washington, D. C., Dr. F. V. Hayden in charge.

The locust area assigned to each Commissioner the present year is as follows:—

1. Prof. Riley takes for his field the region east of the mountains and south of the 40th parallel, the west half of Iowa, and, conjointly with Dr. Packard, British America west of the 94th meridian, where the principal source of the devastating swarms will probably be found.

2. Dr. Packard will take for his field West Wyoming, Montana, Utah, Idaho, and the Pacific Coast.

3. Prof. Thomas takes all the region east of the mountains not enumerated, including Nebraska, Minnesota, etc.

The publications will consist of circulars, bulletins, memoirs, and the annual report of doings and results of the work of the Commission.

To Prof. Riley are assigned more particularly the following divisions of the subject: Biology, or Natural History; Insect Enemies and Parasites; Remedies and Devices for Destruction.

To Dr. Packard: Anatomy and Embryology.

To Dr. Packard and Prof. Thomas, conjointly: Meteorological Bearings and Migrations.

To Prof. Thomas: Geographical Distribution, Enemies not Entomological, Agricultural Bearings of the Subject.

The Commission expects to secure co-operation with the United States Signal Bureau in affording meteorological data in connection with a study of the migrations of the locust; also, hopes to secure the aid of the Canadian Government in co-operating with it in its investigation in British America.

It is the determination of the Commission to confine its operations more particularly to the practical bearings of the subject, with a view to ascertain all possible remedies against these destructive insects. All else will be made subservient to the great object for which the appropriation was made, to wit:—

1. The best means of fighting the plague as it occurs in the States to which it migrates, but in which it is not indigenous.

2. The thorough investigation into its habits in its native home, with a view of preventing, if possible, its migrations therefrom.

The following are the topics on which data are requested from observers in all parts in reference to the destructive locust:—

1. Date, and time of day of the arrival of swarms.
    1*a*. Direction and force of the wind at the time.
    1*b*. Temperature and character of the weather at the time (clear or cloudy).
    1*c*. Direction of the flight, density, height and extent of the swarms.

2. Date and time of day of the departure of the swarms.
    2*a*. Direction and force of the wind at the time.
    2*b*. Temperature and character of the weather at the time.
    2*c*. Direction of the flight, density and extent of the swarms.

3. Date when the first eggs, if any, were deposited the present year.
4. Date when the eggs were most numerously hatching the present year.
5. Date when the eggs were most numerously hatching in previous years.
6. Proportion of eggs that failed to hatch the present year, and probable causes of such failure.
7. Nature of the soil and situations in which the eggs were most largely deposited.
8. Nature of the soil and situations in which the young were most numerously hatched.
9. Date at which the first insect acquired full wings.
10. Date when the winged insects first began to migrate.
11. Estimate the injury done in your County and State.
12. Crops which suffered most.
13. Crops most easily protected.
14. Crops which suffered least.
15. The prevailing direction in which the young insects travelled, and any other facts in relation to the marching of the young.
16. The means employed in your section for the destruction of the unfledged insects, or to protect crops from their ravages, and how far these have proved satisfactory.
17. The means employed in your section for the destruction of the winged insects, or to protect crops from their ravages, and how far these have proved satisfactory.
18. Description, and, if possible, figures of such mechanical contrivances as have proved useful in your locality for the destruction of either the young or the winged insects.
19. If your section was not visited in 1876, please state this fact.
20. If visited any previous year, please give the dates.

21. To what extent have birds, domestic fowls, and other animals, domestic or wild, been useful in destroying these insects?

As the successful prosecution of this work is as deeply important to the western portions of our Dominion (where immense damage is often inflicted by this destructive foe) as to any part of the United States, it is hoped that our Government will render all possible aid to the work of this Commission, either by instructions to parties engaged in surveys and other Government work in the western regions, to make the necessary observations, or otherwise by appointing suitable co-operating agencies to aid in the work.

No official report of the results of the labours of this important Commission has yet appeared, but the following telegraphic summary of the work of the season has lately been printed in the public newspapers:—

U. S. ENTOMOLOGICAL COMMISSION.

REPORT OF ITS LABOURS IN THE NORTH-WEST.

The Rocky Mountain Locust—His Parasites and Winged Enemies.

HOW THE GRASSHOPPER PLAGUE MAY BE STOPPED.

ST. LOUIS, Nov. 12.—The labours of the United States Entomological Commission, appointed by Secretary Shurz last spring, to investigate the grasshopper plague, are drawing toward a conclusion. The Commission consists of Prof. C. V. Riley, State Entomologist of Missouri; Cyrus Thomas, State Entomologist of Illinois; and Prof. A. S. Packard, Jr., a Professor in the Peabody Academy of Science, of Salem, Mass.

The commissioners were appointed on the 20th of March, and a couple of weeks later the three members were out on their exploring tour. Prof. Riley took the States of Texas, Kansas, Iowa, and Colorado, and the British possessions as far north as the Saskatchewan Valley, and his investigations were to be directed more particularly to the biology of the grasshopper, generally called Rocky Mountain locust by entomologists, its entomological enemies and parasites, and remedies and devices for the prevention of the grasshopper plague. Prof. Packard's field was Montana, Utah, Idaho, the Western part of Wyoming, and the Pacific Coast, and he made a study of the anatomy and embryology of the grasshopper. The territory assigned to Prof. Thomas, embraced Minnesota, Nebraska, the eastern part of Wyoming, and all the other states and territories west of the Mississippi not taken by Profs. Riley and Packard; and the special subjects assigned to him were the geographical range of the grasshopper, his enemies not entomological, and the agricultural bearings of the subject. The original bill prevailed for a commission of five, and an appropriation of $25,000. Congress cut the money down to $18,000, and reduced the number of commissioners to three. Prof. Riley says all the commissioners met with unexpected success in their investigations. They met with the most cordial receptions among the people of the west and south-west everywhere, and were furnished by the farmers with a vast amount of valuable information which they never could have obtained if the informants had not felt themselves personally interested in the work of the commission. The U. S. signal bureau also aided the commissioners materially in furnishing them with accurate meteorological data, very necessary in the study of the migrations of the grasshoppers and their ova-deposits, as also the effect which climatic changes have upon them. Prof. Riley spent six weeks in the country in which the principal armies of grasshoppers are hatched, and which they leave as soon as the short, dry grass of the country, on which they principally subsist, is gone. The country is very thinly settled, but the professor was afforded every possible assistance in his investigations by the authorities of the Canadian Government, including Governor Morris and the Ministers of Agriculture and the Interior. Remaining in the British possessions about six weeks, Professor Riley closed his investigations and returned to Chicago, where he again met his fellow commissioners, Profs. Packard and Thomas, just returned from the districts visited by them Notes were again compared, views interchanged, and statistical and other matter exchanged, and the commissioners separated once more, returning this time to their respective homes to write up the results of their investigations. Prof. Riley has been at home now five or six weeks, and has been engaged on the report ever since his return. He expects to complete the report by the middle of next month, and Profs. Packard and Thomas are to have theirs completed about the same time, when the commission will convene again and submit their labours as one work to the Government.

The result of the investigation of the commission has verified previous reports of Prof. Riley's individual investigations, and the commissioners are all of the opinion that a recurrence of the grasshopper plague can be prevented. They have found the native home of the insects; they know on what they feed, and when and under what conditions they migrate, the direction they take, and the distance they go, and the length of time they remain before they commence their homeward flight again. They know, also, the fatal effect that heavy rains and sudden changes of weather have on them, and that smoke will kill them as quickly as fire. They know, too, the parasites which live on the grasshoppers, and the birds—particularly the grackle and the English rook—that feed upon them. Knowing all this, they believe that the migration from British America can be, in a great measure, stopped, and that in case they do visit the fields of Missouri, Kansas, and other States of the union, the farmers can be forewarned in time to prepare for them with fire and water. The commission will recommend measures to Congress, looking to a Governmental treatment of this plague at its next occurrence.

NOTES ON LARVÆ—FONDNESS FOR WATER—HINTS TO BEGINNERS.

BY C. G. SIEWERS, NEWPORT, KY.

(*From the Canadian Entomologist.*)

Last spring, while collecting beetles under the bark of decayed logs, I met with numbers of the larvæ of *Arctia isabella* (hairs brown in the middle, black at each end of larva), about to spin up. Not knowing their hybernating habits, they had always baffled me, and under the impression that they would require another season to mature, had been turned loose. I collected some twenty, put them into a box with cotton and paper scrap, and they at once spun up, all but four. These wandered up and down for a week, having some want, and wasting away. It struck me they might want water. Wetting a sable, I proffered a drink. They all drank greedily, grasping the brush with their fore-legs, and even following it around, I watered them two or three days, but tired of this and threw them out. The same day they were found spinning up on the fence. This spring I collected another lot, and gave them some curved bark to spin in. About one-half refused to spin. I soused them with water. Two remained contumacious, but another wetting brought them to terms. The black larva of the Great Leopard Moth, *Ecpentheria*, hybernates also, spins up about the first of June, and emerges about the 15th with us. Feeds on Poke-berry plant, and will eat cabbage. I failed to winter some twenty this season. Either they dry up in the house, or mould in the cellar. They should be wintered out-doors, in a box without bottom placed on the ground and half-filled with leaves and brush, exposed to the weather, but having proper drainage. They come out of the leaves in the spring distended by moisture. Whether they feed before spininng is uncertain. I collect them in the fall at the foot of willow trees, when digging up the pupa of *Smerinthus geminatus.*

It is generally claimed that moist leaves will induce scouring in the *Bombix mori*, but out-door larvæ get abundance of rain and dew, and may require it. In confinement they fail to get their full growth. Their food should be sprinkled daily. The great difficulty of keeping the food fresh deters many from rearing larvæ. To such I would say, try tin boxes or glass jars. Clean daily and keep moist. Two or three drops of water are sufficient. I have had a lot of empty fruit cans capped, and have kept food fresh in them for ten days. When the nearest food plant is three miles distant this is some object. I find that they do not require light, and but little air. When they cease feeding, remove to spinning or ground boxes. The ground must be kept moist, or the larva will be unable to remove the skin around the thorax, and strangle. If they find it too dry they will come out and try to escape. Many wander about for a day or two before burying themselves. Covering the ground with sod often expedites matters. When ten days have passed they may be sifted out to give place for others, and laid out in another ground box on top, as it is preferable to have them in sight, on account of vermin. Never pull larvæ from their food, especially when moulting in changing food. Clip the old food off around them, and they will change themselves. Placing some hungry *Apatura clytons* three inches from fresh food, they struck a bee line for it.

Raising larvæ is by far the most instructive feature of Entomology, and very interesting. Entirely too little attention is paid to it. We want the whole life. How utterly ignorant we are, for instance, about the larvæ of *Catocalae?* Let all faulty females be confined, and they may lay impregnated eggs; try the young on willow, walnut, or oak leaves. The female is known by the heavy body tapering to a point; the male terminates in a pair of claspers. Some species are readily determined by their antennæ, the males being more broadly pectinated than the females.

The larvæ of wood-boring beetles can be raised in tin or glass on wet saw-dust (not pine); any mixed hardwood or poplar will do. I have kept them so six and eight months, changing the saw-dust once a month. But they are very tiresome, as one may have to keep them a year or two.

HOW TO DESTROY CABINET PESTS.

By Prof. James T. Bell, Belleville, Ont.

(*From the Canadian Entomologist.*)

There is nothing more annoying to the experienced, or more discouraging to the young collector, than to have his specimens destroyed by mites, by the *Anthrenus*, or by the larvæ of *Dermestes*. Against the ravages of these enemies there is no security. Paste and paper fail to exclude them; camphor is only a partial protector; and the only safeguard of our cabinets is constant vigilance, and the instant destruction of the offenders when observed.

For this purpose many methods have been suggested—saturation with turpentine, immersion in alcohol or benzine, exposure to a heat of 210 degrees in a drying closet or oven, &c.; but most of these ways are apt to injure, or even destroy, the specimens, while the last is often ineffective. Having, however, found a certain and rapid method of dealing with these intruders, I desire, through your pages, to make it known to my brother naturalists.

Some two years ago I had a magnificent female *Platysamia (Saturnia) cecropia* measuring 6⅞ inches across the wings when set out, which came out of a chrysalis in my breeding-box. I succeeded in killing and stretching it without damage, and when dry, transferred it to my interim box, which hung against the wall. In about a fortnight I was annoyed to see its antennæ cut off, the head and thorax denuded of most of their down, and some large holes made in the abdomen. After some consideration, I placed a gallipot, containing about 25 grains of cyanide of potassa roughly bruised, with a very little water, in the bottom of the case. I then introduced six drops of sulphuric acid, and let down the glass. In less than a minute I had the satisfaction of seeing a fine, stout *Dermestes* larva writhing in the death agony on the bottom of the box. Since that time I have tried the same several times, and always with the same success. It is equally applicable to the destruction of moths, &c., in stuffed birds and quadrupeds as no animate being can inhale this gas and live.

James T. Bell,
Belleville, Ont.

[Note.—Great caution would be necessary in using this remedy, not to inhale any of the highly poisonous gas which, by the use of the ingredients named, would be rapidly generated.—Ed.C. E.]

RECENT ENTOMOLOGICAL WORKS.

The following brief notices of some of the most valuable Entomological publications which have appeared during the past year, are from the pages of the *Canadian Entomologist*:—

Economic Entomology, by Andrew Murray, F. L. S., London, England. Aptera, 8vo., pp. 433, profusely illustrated with wood-cuts.

This useful volume is the first of a series of hand-books which are intended to serve as guides to the different departments of the collection of Economic Entomology in process of formation at the Bethnal Green branch of the South Kensington Museum, and also as practical treatises for the use of the public generally. In order the better to serve its primary purpose of guide to the collection, the contents of the several cases are described in this volume in the order in which they present themselves to the visitor, containing in some instances other specimens than insects. The work opens with a short chapter on Crustaceans likely to be mistaken for insects; for example, species of *Oniscus*, *Porcellio*, and *Armadillo*. Next in order are the Miriapods—Julidae and Scolopendridae; then Scorpions and their allies; Spiders, Mites, Lice, Thysanura (Spring tails) and Lepismidae. Three new genera and thirteen new species are described in this volume.

The descriptions are briefly and plainly written, and the habits and life history of the species are delineated in a pleasing and popular manner. The work is well printed in good, clear type, and most of the illustrations are excellent. Already we have found it very useful, giving in a condensed form a vast amount of information not otherwise readily obtainable. We heartily commend this work to our readers, and trust that the talented author may be spared to complete the series proposed, which will appear in the following order:— 2nd vol. Bugs; 3rd, Locusts, Grasshoppers, Cockroaches, and Earwigs; 4th, Two-winged Flies; 5th, Bees, Wasps, &c.; 6th, The Dragon Flies and May Flies; 7th, Butterflies and Moths, and lastly, the Beetles.

Ninth Annual Report of the Noxious, Beneficial and other Insects of the State of Missouri. By Chas. V. Riley, State Entomologist, March, 1877; 8vo., pp. 129, with 33 illustrations.

We welcome the ninth of this series of valuable reports with much pleasure. The following are the subjects treated of in the order in which they appear; The Gooseberry Span Worm; the Imported Currant Worm; the Native Currant Worm; the Strawberry Worm; Abbott's White Pine Worm; LeConte's Pine Worm; the Colorado Potato Beetle; the Army Worm; the Rocky Mountain Locust; the Hellgrammite Fly, and the Yucca Borer. The bulk of the report, sixty-seven pages in all, is occupied with details in reference to that terrible scourge of the West, the Rocky Mountain Locust, *Caloptenus spretus*, the other and less important subjects being much more briefly treated of. These reports contain an immense fund of valuable information, and have done much to popularize Entomology in America.

CATALOGUE OF THE LEPIDOPTERA OF AMERICA NORTH OF MEXICO.

BY W. H. EDWARDS.

PART I—*Diurnals.* (*Published by the American Entomological Society, Philadelphia, 8vo. pp. 68 Price $1; interleaved for additions, $1.30.*

This work of Mr. Edward's is conservative in its character, and as such is most refreshing; after having tried in vain to fathom the innovations with which we have for the past few years been perplexed, this excellent catalogue comes to our rescue, and will, we feel sure, be appreciated by all who do not believe in the excessive multiplication of genera and their establishment on minute and often variable characters. Here the dear old familiar names are nearly all in their places again, and we go back to the time-honoured method of heading our collections with *Papilio*, and embracing in it some 22 species.

For ourselves, we have for some time past been literally at sea in reference to names for butterflies, wandering about without chart or compass to direct us; we scarcely knew the name of any species, and didn't expect ever to have the time or disposition to master the new names proposed, and hence we have been so discouraged that we have done really nothing to our collection of butterflies for a long time past. We are not disposed to object to changes in nomenclature where it can be made to appear that a *necessity* for such modifications exists, but we have been unable to see any good reason for adopting the wholesale changes which have been proposed, and we believe that the great bulk of working Entomologists hold the same view. With a catalogue now more to our mind, sufficiently progressive, and, at the same time, a most convenient help, we shall be able to classify our species under genera we can comprehend, and go to work with a will again.

In the general arrangement the author, while adopting and incorporating some of the work of later systematists, adheres mainly to the order of Doubleday and his associates in the "Genera of Diurnal Lepidoptera," and where the genera have numerous species, as in *Colias*, *Argynnis*, *Thecla*, *Lycaena*, *Pamphila*, &c., they are for the sake of convenience divided into sections. In crediting genera the author strictly follows the rules adopted by American Entomologists at the recent meeting in Buffalo, and appends the name of the party who first gave the genus a proper definition. For this reason Hübner's genera are excluded and two of the genera made by Mr. Scudder in the Hesperidæ, *Amblyscirtes* and *Pholiosora*, have been credited to Dr. Speyer because his definition of them is the first published. With regard to Mr. Scudder's genera, we think he should have had credit for them. We all know what pains-taking and unsparing effort he has bestowed in labouring to introduce what he conscientiously believes to be needed reforms in Entomological nomenclature, and although the present generation of Entomologists is not disposed to adopt such wholesale reform as he proposes, he is undoubtedly *deserving of full credit* for any of his material which may be used. His work on New England Butterflies, in which all these genera are minutely defined, has long been written, but its expensive character has been an obstacle in the way of its publication. Under these circumstances, *which are very exceptional,* we regret that Dr. Speyer's references of these genera to Scudder have not been followed.

There are 506 species enumerated in this list, embraced in 64 genera. There are also references by the use of a system of special signs to all writers who have treated of the preparatory stages of our butterflies, no matter how briefly; we regard this as an excellent and valuable feature in the work. The catalogue is in every way well got up, and we hope all our readers will procure a copy of it, and if, after they have given it a careful perusal, they think as well of it as we do, they will set to work and arrange their collections in accordance with it, feeling profoundly thankful to the author for the timely relief he has afforded.

The Rhyncophora of America, north of Mexico, by John L. LeConte, assisted by George H. Horn. From the Proceedings of the American Philosophical Society, Vol. 15.

This work, which fills a volume of 455 pages, is probably the most important contribution which has been made to the Entomology of America for many years. Its production must have been attended with immense labour and long and careful study. In addition to the work of classifying this numerous and difficult group of insects, a very large number of new species are described. We tender our sincere thanks to the authors for their kindness in sending us a copy of this useful and long-needed memoir.

Manuscript Notes from my Journal, or Illustrations of Insects Native and Foreign; Order Hemiptera, sub order Heteroptera. By Townend Glover, Washington, D. C.

In the 12th No. of Vol. vi., we called the attention of our readers to the issue of a valuable work by the same author on Diptera. The volume now at hand on the Hemiptera is published in similar form and style, quarto, on heavy paper, printed on one side only, and the text a fac-simile of the author's handwriting. In this volume their are ten excellent plates, nine of which are devoted to the illustration of the species to which the notes refer, and one to the figuring of those portions of the insects on which their classification is based. There are figures of 238 species, many of the smaller ones in duplicate, one showing the insect magnified, the other of the natural size. In addition to the plates and there explanatory matter, there are 134 pages of text, 2 explanatory, 17 devoted to the classification of the Hemiptera, and the remainder to notes on the insects themselves, their habits, the animal and vegetable substances they injure, the remedies used for destroying them, &c., all being referred to in alphabetical order.

This work is another evidence of the indomitable perseverance of this energetic Entomologist, and will be a valuable aid to those who desire to study this hitherto much neglected order. The author has again placed us under deep obligation for his kind remembrance of us.

The Rocky Mountain Locust; being report of proceedings of a conference of the Governors of several western States and Territories, together with several other gentlemen, held at Omaha, Oct., 1876, 8vo., pp. 58.

We are indebted to our esteemed friend, C. V. Riley, for a copy of the above pamphlet, which contains much valuable information on the habits of this destructive pest, as well as a summary of the best means yet known for counteracting its ravages.

Packard's Half Hours with Insects, Boston, published by Estes & Lauriat, 1877, 12mo., pp. 384, illustrated, $2.50, which was originally issued in twelve numbers, has lately been published in book form. We desire to correct some typographical and other errors of importance. Page 187, in explanation of Fig. 188, for Bucculating read Bucculatrix; page 289, line 23, for *Disippus* read *Archippus*, and in line 25, for *Archippus* read *Disippus;* page 305, line 13, for sumac, read cottonwood, and on page 306, in explanation of Fig. 236, for sumac gall read vagabond gall. We cheerfully commend this useful work to our readers.

Report upon the Orthoptera collected by the Wheeler Expedition, by Samuel H. Scudder; 8vo., 17 pp. In this paper the author gives much valuable information in relation to the Orthoptera occurring on the eastern slope of the Rocky Mountains; 17 new species are described, and definitions of 8 new genera given. Report of the Hayden Expedition, from the Department of the Interior, containing Brief Synopsis of North American Ear-wigs, with an appendix of the fossil species; 8vo., 12 pp. List of Orthoptera collected by Dr. A. S. Packard, in Colorado, &c., during 1875; 8vo., 7 pp. Notice of a small collection of Butterflies made by Dr. Packard in Colorado and Utah. All by Samuel H. Scudder. We tender our best thanks to the author for copies of these papers.

Harpalus caligenosus from Nature, by Franklin C. Hill; two plates. We are indebted to Mr. Franklin C. Hill, of Princeton College, N. J., for copies of these excellent plates, recently published. They are beautifully finished and conveniently mounted on cards, 5 x 8, with all the organs and divisions both of the under and upper surface, distinctly named. They will prove a valuable help to beginners, and indeed to all who are not already familiar with the names of the different portions of the body of Coleopterous insects.

A FEW COMMON WOOD-BORING BEETLES.

BY THE REV. C. J. S. BETHUNE, M.A., PORT HOPE, ONT.

EXPLANATION OF THE PLATE.

Fig. 1. *Monohammus scutellatus*, Say—A Pine-tree Borer.
Fig. 2. *Clytus speciosus*, Say.—The Maple-tree Borer.
Fig. 3. *Orthosoma cylindricum*, Fab.—A Pine-tree Borer.
Fig. 4. *Clytus robiniæ*, Forst.—The Locust-tree Borer.
Fig. 5. *Chrysobothris femorata*, Fab.—The Buyrestis Apple-tree Borer.
Fig. 6. *Saperda candida*, Fab.—The White-lined Apple-tree Borer.
Fig. 7. *Monohammus confusor*, Kirby.—The Pine tree Borer.
Fig. 8. *Oberea tripunctata*, Fab.—The Raspberry Twig Girdler.

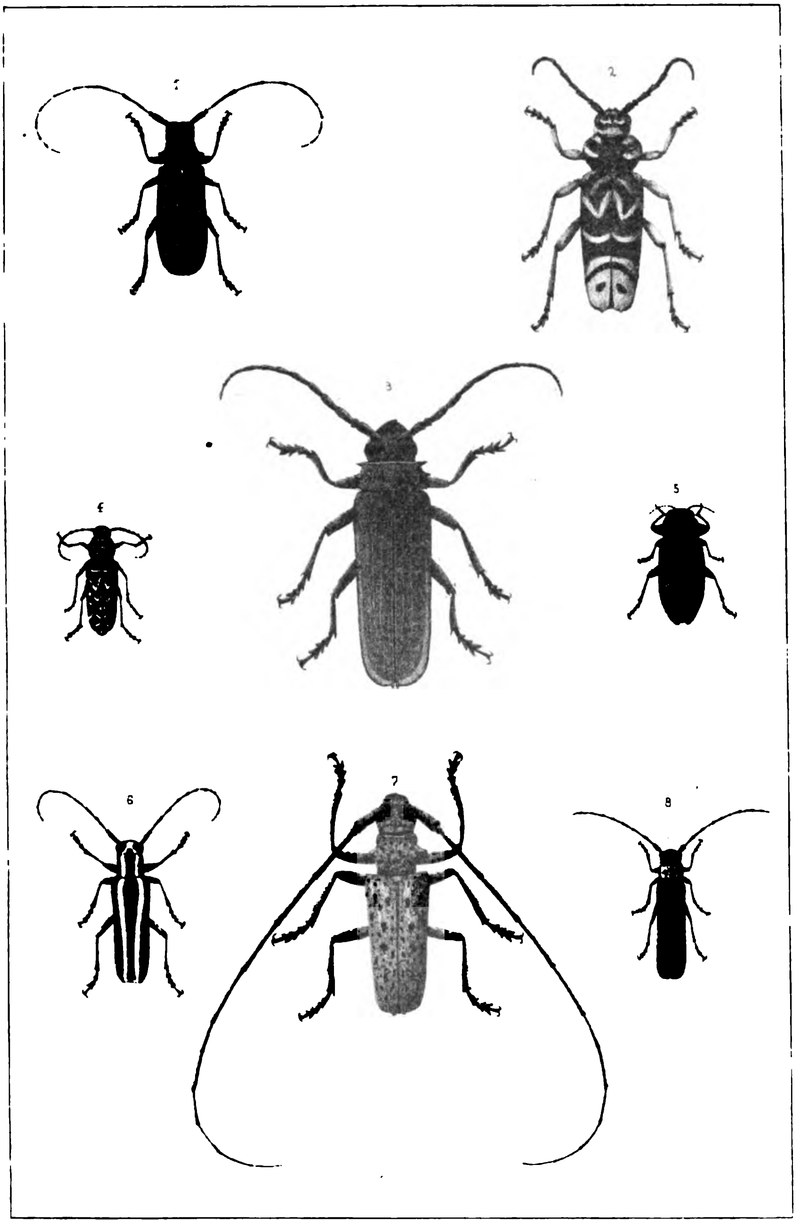
Our Canadian wood-boring beetles, with the exception of a few somewhat minute species, belong to the two great families of Buprestidæ and Cerambycidæ. These include an immense number of different genera and species; in Crotch's List of the Coleoptera of North America (north of Mexico), there are enumerated the names of no less than 169 species of the former family and 552 of the latter, about one-third of these are found in this country. It is evident, then, that to give a bare list of all our Canadian species of wood-borers would occupy no little space, while a detailed description of them, if one were competent for the task, would fill many issues of this Report. We propose, therefore, on the present occasion to merely give a brief account of the eight species depicted on the accompanying plate. These we have selected on account of their frequent occurrence in almost all parts of the country, and the consequent familiarity of their appearance even to non-Entomologists. Our readers will, we are sure, be pleased with the beauty of the figures, which have been admirably drawn upon stone by Mr. L. Trouvelot, of Cambridge, Massachusetts.

Taking the species in the order in which they are numbered on the plate, we come first to

I. MONOHAMMUS SCUTELLATUS, Say—A PINE-TREE BORER.

This beetle, which derives its specific name from its conspicuously white scutellum, is of a shining black colour on both the upper and under surfaces, thickly punctured with irregular impressions; on the wing-cases there are, as shown in the figure, a number of scattered whitish spots of various shapes and sizes; these, on close inspection, are found to be composed of dense short white hairs, which often become rubbed off and disappear; the thorax is armed on each side with a thick triangular spine; the antennæ are many-jointed, and about the same length as the body in the male, while in the female they are about twice that proportion. The size of the beetle varies from less than half an inch in the male to over three-quarters of an inch (exclusive of the antennæ) in the female. The larva is a large thick white grub, destitute of legs, divided into a number of well-marked segments; the head armed with a strong pair of jaws. The larva infests the pine, after the timber has been cut or newly fallen, and often causes serious injury to it by boring large oval-shaped holes which extend for long distances through the interior of the log. The perfect insects appear in June, and are sometimes very abundant; we have occasionally found them swarming in great numbers on fallen pine trees. The insect is common throughout Canada and the neighbouring States.

The following general account of the larvæ of the family (*Cerambycidæ*), to which this beetle belongs, taken from Harris's Injurious Insects, pages 93–4, will be of interest, and will enable the reader the more readily to understand the structures and habits of these borers in their earlier stages. "The larvæ hatched from the eggs—which are laid by the parent beetle in holes and chinks of the bark—are long, whitish, fleshy grubs, with the transverse incisions of the body very deeply marked, so that the rings are very convex or hunched above and below. The body tapers a little behind, and is blunt-pointed. The head is much smaller than the first ring, slightly bent downwards, of a horny consistence, and is provided with short but very powerful jaws, by means whereof the insect can bore, as with



L. Trouvelot

a centre-bit. a cylindrical passage through the most solid wood. Some of these borers have six very small legs, namely, one pair under each of the first three rings, but most of them want even these short and imperfect limbs, and move through their burrows by alternate extension and contraction of their bodies, on each or on most of the rings of which, both above and below, there is an oval space covered with little elevations, somewhat like the teeth of a fine rasp ; and these little oval rasps, which are designed to aid the grubs in their motions, fully make up to them the want of proper feet.

"Some of these borers always keep one end of their burrows open out of which, from time to time, they cast their chips, resembling coarse saw-dust ; others, as fast as they proceed, fill up the passages behind them with their castings, well known by the name of 'powder-post.' These borers live from one year to three or perhaps four years before they come to their growth. They undergo their transformations at the furthest extremity of their burrows, many of them previously gnawing a passage through the wood to the inside of the bark, for their future escape. The pupa is at first soft and whitish, and it exhibits all the parts of the future beetle under a filmy veil which enwraps every limb. The wings and legs are folded upon the breast, the long antennæ are turned back against the sides of the body, and then bent forwards between the legs. When the beetle has thrown off its pupa skin, it gnaws away the thin coat of bark that covers the mouth of its burrow, and comes out of its dark and confined retreat, to breathe the fresh air, and to enjoy for the first time the pleasure of sight, and the use of the legs and wings with which it is provided." This account of the larval and pupal state of the long-horned beetles, applies more or less closely to all the insects described in this paper, with the exception of No. 5, *Chrysobothris femorata*, which belongs to the *Buprestidæ*, a totally different family of beetles.

II. CLYTUS SPECIOSUS, Say (genus *Glycobius*, Lec.)—THE MAPLE-TREE BORER.*

The colours of this very handsome insect are deep velvety black and bright yellow. The figure represents its shape and markings so accurately that further description is unnecessary ; the size depicted, however, is decidedly above the average. This wasp-like beetle is not very abundant, but may occasionally be found on Maple trees, which its larvæ infest both when growing in the forest and also when cut into cord-wood. The eggs are laid by the parent beetle on the trunk of the Sugar-maple during the middle of summer ; when hatched the grubs penetrate through the bark and make long winding borings through the solid wood. Occasionally they are very destructive to young Maple trees, but on the whole they are not so sufficiently numerous to be objects of dread. Should they at any time threaten injury to these favourite shade trees, the larvæ may be got rid of by passing a somewhat flexible wire into their burrows until it reaches the grub within. The entrance may be discovered by the sawdust that they cast out.

III. ORTHOSOMA CYCLINDRICUM, Fab.—A PINE BORER.

This large beetle is the commonest and best known of our wood-borers ; its habit of flying through open windows into lighted rooms during the warm evenings of July, usually to the great alarm of the inmates, has caused its appearance to be very familiar to every one. It is one of our largest beetles, measuring oftentimes as much as an inch and a half in length by over a third of an inch in breadth. Its general colour

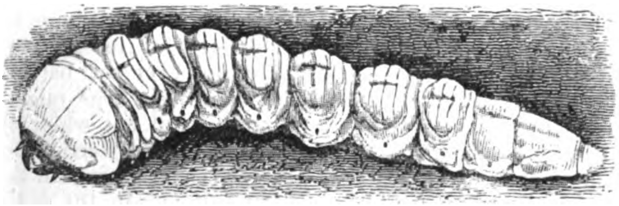


Fig 1.

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*A full account of this insect, by Mr. E. B. Reed, will be found in the Report of the Entomological Society for 1872.

is a chestnut brown, approaching black on the head and antennæ. The thorax is armed with three sharp spines on each side; each wing-case has three slightly elevated ridges running lengthwise for nearly the whole length; the eyes, which are situated behind the antennæ, are enormously large and very conspicuous. The larva (Fig 1) is a large fat white grub, with powerful jaws of a darker colour; it feeds upon the wood of the Pine, and from its size often injures the timber very materially. It will, no doubt, however, be considered a decidedly beneficial insect by some of our readers who live in newly-cleared settlements, when we mention that it affects pine-stumps especially, and often aids materially in reducing them to a state of rottenness.

The perfect insect, like most of the long-horned beetles, possesses the power of making a curious creaking noise. In the generality of species this is produced by rubbing the joints of the thorax together, or against the base of the wing-covers; but this species, according to Professor Riley (*Canadian Entomologist*, vol. iv. p. 140), "is a true fiddler, stridulating, like the *Orthopterous Locustidæ*, by rubbing the hind femora against the elytra. If a specimen be carefully examined, the inside of these femora will be found rasped from the base to near the tip by a number of short longitudinal ridges, which, when played against the thin and sharp emarginations of the elytra, produce the rather loud creaking so peculiar to this beetle."

IV. CLYTUS ROBINIÆ Forst.—THE LOCUST-TREE BORER.

(The synonym of this insect has been rather perplexing; it is now included in the genus *Cyllene* Newm.; for a long time we were accustomed to call it *Clytus flexuosus* Fab., but the specific name given above has the priority. It was also long considered to be identical with *C. pictus*, Drury, that bores into the hickory, but the late Mr. Walsh proved satisfactorily that the two species are distinct. The general colour of this insect is deep black with light yellow stripes; on the head and thorax these stripes form narrow transverse bands, but on the wing-covers there is first of all a narrow yellow anterior edging (not shewn in the figure); then a slightly flexuous stripe (not straight as in the figure; this is followed by a narrow zig-zag band forming a letter W across the wings, and three irregularly wavy and broken stripes; there is also a yellow dot at the tip, and broader stripes on the sides of the abdomen of the same colour. The antennæ are long and many-jointed, and of a dark brown colour; the legs are long and of a tawny hue. The larva is a whitish coloured grub, about an inch long and the thickness of an ordinary goose quill, and is furnished with six very minute legs. When young it appears to bore chiefly into the sap-wood, but afterwards strides off into the solid wood of the tree, perforating it in every direction. Its presence is early indicated by the little heaps of sawdust extruded from the holes, and accumulated about the base of the tree.

The following account of the habits of this insect, by Dr. Harris, (Injurious Insects, page 103), is so excellent and coincides so exactly with our own observations that we cannot forbear quoting it, though it may be familiar to some of our readers. "In the month of September," he says, "these beetles gather on the locust trees, where they may be seen glittering in the sunbeams with their gorgeous livery of black velvet and gold, coursing up and down the trunks in pursuit of their mates, or to drive away their rivals, and stopping every now and then to salute those they meet with a rapid bowing of the shoulders, accompanied by a creaking sound, indicative of recognition or defiance. Having paired, the female attended by her partner, creeps over the bark, searching the crevices with her antennæ, and dropping therein her snow-white legs, in clusters of seven or eight together, and at intervals of five or six minutes, until her whole stock is safely stored. The eggs are soon hatched, and the grubs immediately burrow into the bark, devouring the soft inner substance that suffices for their nourishment till the approach of winter, during which they remain at rest in a torpid state. In the spring they bore through the sap-wood, more or less deeply into the trunk, the general course of their entrance. For a time they cast their chips out of their holes as fast as they are made; but after a while the passage becomes clogged and the burrow more or less filled with the course and fibrous fragments of wood, to get rid of which the grubs are often obliged to open new holes through the bark. The seat of their operations is known by the oozing of the sap and the dropping of the sawdust from the holes. The bark around the part attacked begins to swell, and in a few years the trunks and limbs will become disfigured and weakened by large porous tumours, caused by the efforts of the trees to repair the injuries they have suffered."

The history of this insect is rather a curious one. For a little over a hundred years it has been known to inhabit the State of New York, its appearance and habits being recorded by some English Entomologists of the last century. About thirty years ago it was found as far west as Chicago, whence it spread throughout the State of Illinois, but it was not till 1863 that it reached Rock Island, about two hundred miles further west, where—Mr. Walsh relates—it suddenly appeared in great swarms and utterly destroyed all the Locust trees. The first record we have found of its appearance in Canada is by Mr. Couper, who states (*Can. Journal*, 1855, p. 377) that he observed some Locust trees attacked by this insect in Montreal in September, 1855. In 1862 it began to be very destructive to the Locusts in Toronto, and for several years was excessively abundant there. In 1867 we found it at Credit, about twenty miles west of Toronto; it almost entirely destroyed all the Locust trees in the neighbourhood. In 1873 Mr. Reed relates its appearance in enormous numbers at London, Ont.; now it appears to be generally distributed throughout this province, and occasionally becomes very injurious to these ornamental trees. The perfect insect, in the localities it frequents, may usually be found in September on the flowers of the Golden-rod (*Solidago*), of which it eats the pollen, as well as upon the trunks of the trees it infests.

It is not easy to apply a remedy for an insect of this kind, still much may be done to save favourite trees in one's garden, provided they are not very large. The most satisfactory plan seems to be to rub over the trunk and large limbs of the tree with strong soap about the end of August; this will prevent the mother-beetle from laying her eggs upon the bark in September. Of course the application will have to be renewed after heavy showers. Dr. Harris suggests that whitewashing, or covering the trees with grafting-wax, would be effective in repelling the female. It would be of benefit also to gather and destroy the beetles wherever they may be found; children might be employed for this purpose to search the flowers of the Golden-rod as well as to carefully examine the trunks of the trees; should they be too high up to reach, a sharp blow with a stick on the trunk of the tree will cause them to fall to the ground. A little familiarity will soon overcome the natural repugnance to handling so wasp-like a creature.

V. CHRYSOBOTHRIS FEMORATA, Fab.—THE BUPRESTIS, OR FLAT-HEADED APPLE-TREE BORER.

This insect belongs to the family Buprestidæ, while all the others on our plate belong to the Cerambycidæ; the difference in shape and structure, and especially in the length of the antennæ, is very noticeable in the figures. The accompanying wood cut (Fig. 2), when compared with that of the pine-borer given above (Fig. 1), will show our readers how this insect differs in this larval state, also from the long-horned beetles The larva is shown at *a*, the chrysalis at *b*, the head and first segments of the larva at *c* and the perfect beetle slightly enlarged at *d*.

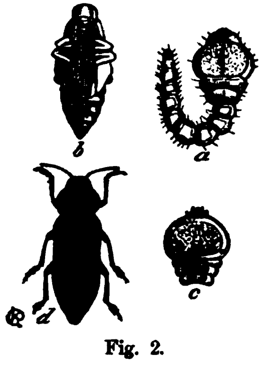


Fig. 2.

The natural history of the insect may be briefly related, as follows: The egg is deposited by the female beetle in the chinks and crevices of the bark some time during the early part of summer; from this the young grub soon hatches, and works its way into the soft sap-wood immediately beneath. Here it eats away, while the cavity inside becomes larger and larger, and it increases in size itself, gradually working upwards until it becomes pretty well grown, when it bores into the solid heart of the wood, and forms a flattish burrow, corresponding to its own flat form. When several attack the same tree, as is generally the case, their burrows, of course approach very near each other, and cause its death; in any case, they very much injure its vitality and bring on decay. In the spring of the year the grub assumes its pupa state, and comes out as a perfect beetle in the end of June, or during July, when it may be found basking on the tree trunks in the hot sunshine. It is very lively when danger threatens, and will take wing instantly if an attempt is made to catch it. Its blackish colour above so much resembles the bark of the tree that it readily escapes the notice of an ordinary observer; but beneath it is of a beautifully burnished dark copper-colour, looking as if it were made of metal, beneath the wing covers it is bluish. While the figure gives the shape of the insect very correctly, it much exaggerates its size, which seldom exceeds three-eighths of an inch; the light spots on the wing-cover are also erroneous in being very much too conspicuous.

The presence of the grub in the tree may be detected by the discolouration of the bark, and its flattened, dried appearance. All such spots should be opened with a knife, and the insect at once despatched. The burrows may be discovered by the presence on the bark of the fine sawdust cast out by the larva.

The insect attacks not only the apple, but also different kinds of oak, especially the white oak, and according to Prof. Riley, the mountain ash, linden or bass-wood, box-elder, beech, plum, pear, cherry and peach.

With regard to remedies, one important fact—we quote from Prof. Reily, (7th Missouri Report, page 76) should be borne in mind. The natural breeding place of the insect is undoubtedly in the old decaying oaks of our woods, and I have known it to swarm in old post-oak stumps from which the tops had been felled for a number of years. In fact it prefers partially dead or injured trees to those which are thrifty and vigorous, and partly for this reason, and partly because rough, cracked bark forms a better nidus to lay her eggs, the species is most abundantly found on the south-west side of young apple trees where they are most apt to get injured by sun-scald. Sickliness in the tree, or injury from any cause predisposes to its attacks. It is for this reason that transplanted trees, checked as they are in their growth, usually fare badly. But there is yet one other predisposing cause which few people suspect, and that is reckless and careless pruning, especially of the larger branches. Many a fine orchard tree, and many more city shade trees, receive their death shock from the reckless sawing off of limbs without effort being made to heal the wound by coating with grafting-wax, clay or other protecting substance. Around such an unprotected sawed limb, as around the frustum of a felled tree, the rain and other atmospheric influences soon begin their work of causing decay between the bark and the solid wood; and this is but the forerunner of greater injury by insects which are attracted to the spot, and which, though hidden meanwhile from view, soon carry the destruction from the injured to the non-injured parts. Among the insects thus attracted, the Chrybothris plays no mean part, where, had the wounded limb been protected, its presence would never have been known. It thus becomes of the first importance in treating this insect, to keep the young trees vigorous and healthy, and the bark as smooth and as free from injury as possible. Young trees are far more liable to be attacked than old ones, and consequently require greater care."

As a preventative against the insects' attacks there is nothing better than coating the trunk and larger branches with soap at least twice a year, once toward the end of May, and again in July or August. The soap is not only obnoxious to the beetle, but it tends to keep the bark clean and smooth, so as to offer no attraction to the female, and is withal beneficial to the tree. The trees should also be examined carefully late in the fall. At this season, or even in the winter time, the young borers which have just commenced work, are easily detected and destroyed by a knife before they have done much harm.

VI. SAPERDA CANEIDA, Fab.—THE TWO-STRITED APPLE-TREE BORER.

This insect, which rivals the foregoing species in the injuries it inflicts upon Apple trees, is a pale-brown beetle with two chalky-white longitudinal stripes running from the head to the apex of the wing-covers; its under side, legs and face are also chalky-white, and its antennæ a little darker; its length is about three-quarters of an inch. The larva is of a pale yellow or whitish colour, with a brownish polished head and black jaws; it is destitute of legs, but like other larvæ of the same family, it is enabled to move in its burrows by the contraction and expansion of its well-defined segments; when fully grown it is about an inch long. It may readily be distinguished from the preceding species by its cylindrical and more symmetrical shape, as is apparent from the accompanying figure (Fig. 3). The larva is shown at *a*, the pupa or chrysalis at *b*, the perfect beetle at *c*.

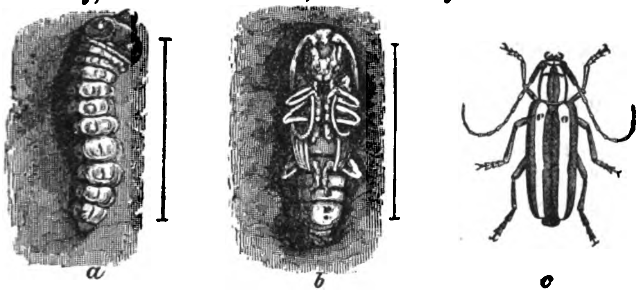


Fig. 3.

The perfect insect (to quote from our Report for 1870) makes its appearance in June and July, but is seldom seen, as it usually remains in concealment during the day, and flies only at night. The females deposit their eggs upon the bark of the tree near the base of the trunk, or collar as it is termed. From the eggs are soon hatched out tiny whitish grubs, which penetrate the bark and leave a hole so minute that it soon closes up. For the first year the grub feeds only upon the sap-wood, in which it excavates a round smooth cavity immediately beneath the bark, generally nearly filled, when opened, with the saw-dust-like castings of the worm. These castings may very frequently be observed extruded from the burrow and on the ground at the base of the tree; whenever they are noticed search should at once be made for the borer within. As this borer does not occur in any part of Canada in which we have resided, we have had but little opportunity of investigating its habits, we therefore quote the following excellent account from our friend Mr. Beadle's Prize Essay on the Apple (*Fruit Growers' Report*, 1868, *p.* 172): "When the grub has become about half-grown it ceases to cast the dust out of its cavity, and proceeds to fill it up, at the same time boring a passage or gallery upwards into the heart of the tree. This gallery is continued upwards, of varying length, sometimes not more than two inches, and sometimes twelve inches, and is gradually brought outwards again to the bark of the tree, but not through it. When the grub has completed this gallery, it turns round and returns to that part which is nearest to the heart of the tree; this part it now enlarges by tearing off the fibre from the walls, and with this fibre carefully and securely closes the entrance, so that if some insect enemy should find its way through the hole in the bark at the collar into the chamber where it passed the first part of its life, that enemy could not enter the gallery to its present abode. Meanwhile it crowds its saw-dust like castings into the upper extremity of the gallery against the bark, thus, at the same time, diminishing the danger of attack from that quarter, and keeping its chamber tidy. Having thus perfected its arrangements, it again turns round so as to have its head upward, passes the winter in a torpid state, and in the spring casts off its skin and becomes a pupa, from which in June the perfect insect hatches, climbs to the upper end of the gallery, tears away the fine sawdust, gnaws a hole through the bark and creeps forth." When several of these borers are at work in the same tree, their excavations approach each other so closely as often to girdle the tree and cause its destruction.

Many modes have been proposed for the destruction of this noxious insect, some of them essentially absurd, such as plugging up the holes in the trees which are made by the beetle when taking his departure from the scene of his early life, after he has finished his work of mischief. The simplest and most effectual remedies are: (1) the application of soap (cold made soft soap is especially recommended) to the trunk of the tree early in June and again in July; rub it well over, especially near the base of the trunk, and place a portion in the fork of the tree that it may be washed down into the crevices of the bark by the rains. (2) If the borer has already taken up his abode in the tree, cut into his burrows with a sharp knife and get him out; his presence may generally be detected near the collar of the tree by the discolouration of the bark and by the sawdust castings. This is the most effectual, and by no means difficult remedy; much benefit, however, may also be derived from washing this part of the tree with lye, or any strong alkaline solution, which will penetrate the interstices of the bark and kill any young grubs that may be commencing to make their way inwards. The trees should be carefully examined—especially if young and not long planted out—at different times during the year, as well as in the Spring.

Thus far this most injurious insect has only been found in certain portions of this country, being very abundant in the Niagara district, and in the neighbourhood of Montreal and Quebec, but happily rare, or entirely absent, from almost all other parts. Prof. Bell (in the *Fruit Growers' Report for* 1875) relates that a specimen was captured in the year 1873 near the Town of Belleville; no doubt it was imported, probably in the larval state, in trees from the United States or some other district infested by the insect.

VII.—MONOHAMMUS CONFUSOR, KIRBY.—A PINE-TREE BORER.

This fine beetle, which is especially remarkable for the extraordinary length of its antennæ, is, in our pine regions, one of the most common and destructive of our insect enemies. Its general colour is an ashen grey, mottled with variable darker spots; the scutellum is white; there are also patches of whitish colour on the head, thorax and abdomen. These variations of colour, being due to a covering of very fine short hairs, which oftentimes are rubbed off, are not to be depended upon in the determination of the species. As in *M. scutellatus* (fig. 1,) each side of the thorax is armed with a short thick spine. The length of the insect varied from three-quarters of an inch to an inch and a half—the average size being over an inch; the antennæ of the males vary in length from one and a half to three inches; those of the female are somewhat shorter. The larva is a large, white, somewhat cylindrical grub, destitute of feet. During the summer, the female lays her eggs in crevices of the bark of the white and red pine, selecting for the most part timber that has been scorched by fire, or felled by the wind or the lumberman's axe; the larva when hatched soon eats its way into the wood, and before this period of its existence is closed it often burrows immense galleries through and through the solid interior. As it lives a long time in the larval state, the perfect insect is frequently only developed after the timber has been built into a house, and then suddenly emerges from its concealment to the great consternation of the inhabitants of the dwelling. The larva, when burrowing in the wood, makes a loud noise like the boring of an auger, which on a still night may be heard for a considerable distance. The species is very generally distributed throughout Canada and the Northern States; in the pine-growing regions it is often excessively abundant.

A very interesting and valuable account of this insect is given by the late Mr. E Billings, of the Canadian Geological Survey in the *Canadian Naturalist and Geologist*, for December, 1862, (vol. vii. pp. 440-438). As the work is not likely to be in the hands of more than a very few of our readers, we cannot do better than give some extracts from it. Mr. Billings, from his long residence in the lumbering districts of the Ottawa valley, had more than ordinary opportunities of observing the life and habits of the insect, and may therefore be justly considered an excellent authority upon the subject. "These insects," he relates, "attack dead timber, and also trees which have received some injury, and are in an unhealthy condition. I have never seen the female laying her eggs on a perfectly healthy and sound pine tree. Timber newly fallen is always attacked by them. The first dwellings constructed in the new settlements are generally made of logs with either the whole or a portion of the bark remaining on them. The inside is not plastered, except in the crevices between the logs; if these latter happen to be pine, the *Monohammus* lays her eggs in the bark, on the outside of the house, and for months afterwards the larva may be heard in the stillness of the night, making a noise like the boring of a small augur. The perfect insect sometimes comes out on the inside of the wall, and suddenly drops down upon the floor, the table or the bed, to the great alarm of the inmates, who imagine that an insect with such great horns must bite or sting with proportionate severity.

"For the manufacture of boards or planks, the pine trees are cut up into lengths of from twelve to eighteen feet, and are either drawn or floated to the mill. The logs are got out during the winter, and if they remain in the mill yard one season, they are invariably found to be bored through in all directions by larvæ of these beetles, and the boards greatly deteriorated in value. Where extensive operations are carried on, a single lumberman will sometimes have a license giving him possession of over a hundred square miles of pine forest. In the months of May and June it often happens that great fires sweep through the woods, burning up all the fallen trees and dry branches strewn over the ground, and so scorching the living pines that most of them wither at the top and die during the season. Trees thus injured are soon attacked by both *M. Confusor* and *M. Scutellatus*, and within one year are so greatly bored that they are unfit for the manufacture of timber. Those experienced in the business, however, well understand the habits of the insects in this respect, and hasten to make the timber before it is destroyed. Pines scorched by the spring fires must be cut down and made into lumber the next autumn. After one of these fires it generally happens that there is a regular race between the lumberers and the beetles, the prize being a grove of white or red pine. I was told that Messrs. Egan & Co., lost £40,000 worth of timber by some unavoidable delay of a few months. Pine trees, when scorched, would be sound enough for timber five years afterwards, if it were not for the attacks of these formidable destroyers.

"When there are only a few pines, as in the neighbourhood of Montreal, it is rare to meet with more than one or two of these beetles together. But in the great forests of the Ottawa it is not unusual to find fifteen or twenty on a single tree. On one occasion I saw an extraordinary number, and entered an account of the circumstance in my note-book on the spot. It was on the 11th of September, 1857. I was at that time making some geological observations in the neighbourhood of Lake Clear, in the County of Renfrew. Following on the lumber road through the woods, I came to a place which had been burned over some time during the preceding spring. There was one large white pine standing on the sunny side of a small gently sloping hill. The height of this tree was about 120 feet, and its diameter nearly 3 feet. About 30 feet at the base was scorched; it was 60 feet to the lowest branch, and as nearly as I could judge, the foliage for 20 feet at the very top had turned yellow. The remainder was green, and apparently healthy. This tree was swarming with *M. Confusor*, and many of the females were occupied in laying their eggs. I think there were at least 300 of both sexes, and I saw several flying from other trees thirty or forty yards distant. In flying, the body is not horizontal, but inclined at an angle of only fifteen or twenty degrees from the perpendicular. The insects were on all parts of the tree, and they did not appear to take a firm hold of the bark, for a heavy blow with a hammer, at the base, would bring down a dozen at a time, some of them falling from near the top. While falling, they did not attempt to fly. I had fifty or sixty crawling around me at once, and had a fine opportunity to observe the very considerable variation in the size of the individuals, and the length of the antennæ. When two of them, going in opposite directions, met face to face, a clumsy kind of fight took place, in which they reared up and pushed against each other, until one or other fell over backwards. They bit each other with their mandibles, but with no effect that I could perceive. The females fought with each other, or with the males, indifferently. There can be little doubt but that this tree was, during the next twelve months, totally destroyed. If there were 150 females, and each laid 200 eggs, and half of these produced a healthy larva, then in one year this tree must have been perforated by 15,000 galleries. I examined other trees in the neighbourhood, and on a few only did I see any of the beetles, usually from one to four or five on each. I can only account for the preference given to this particular tree, by supposing that it was in a better condition for the nourishment of the larvæ than the others, and that the instinct of the females directed them to it. It is probable that nearly all the females for a considerable distance around were thus brought together on one tree, and were followed by the males.

"I cannot say whether or not these insects ever attack a perfectly healthy and sound tree. I think they do not, and yet their ravages are certainly injurious to the commerce of this country, as they destroy a vast deal of fallen or scorched timber which otherwise might be brought to market at any time during several years after the trees have received a death blow by fire or storm. I think also that thousands of trees, only sufficiently injured by fire to throw them for a while into a weakly or unhealthy condition, would recover were it not for the attacks of these formidable creatures."

The only means of warding off the attacks of these destructive insects is to manufacture, without delay, all scorched or fallen timber, and to strip the bark off all saw-logs that are left over a summer before being cut up in a mill. When the bark is removed the female has no convenient and safe place in which to deposit her eggs, and thus the timber escapes her attacks.

VIII. OBEREA TRIPUNCTATA, Fab.—THE RASPBERRY TWIG-GIRDLER.

We now come to the last insect on our plate; the figure is a good deal exaggerated in size, the length of the beetle being under half an inch, and its width one-tenth of an inch.

Its colour is deep black, with the exception of the thorax above and the front part of the breast beneath, which are rusty yellow; on the thorax there are three small elevated black dots, arranged in a triangle (not two only, as in the figure), whence is derived the specific name of the insect. The antennæ are nearly, if not quite, as long as the body. The beetles are usually found in July and the beginning of August; they attack all the varieties of raspberry, and come into gardens from the fields and clearings, where we have often taken specimens and observed their work. The mode of attack is peculiar; the first appearance of injury is usually manifested by the withering and drooping of the ends of the young shoots. On inspection, it is found that at the base of the affected part there are two rows of punctures, half an inch apart, running completely round the canes, and so girdling them that the supply of sap is stopped and the tops necessarily soon wither and break off. The parent insect begins by cutting with its jaws a series of small punctures side by side around the cane, six or seven inches from the top. As soon as the first row is completed, it turns round, and facing the other way, cuts a second row, measuring the length of its own body. These two girdles being completed, it makes a small hole a little way above the lower girdle, and deposits in it its small yellow egg. The whole operation occupies an hour or more. From this egg there hatches out in a few days a small, yellow, footless grub, which proceeds to burrow downwards, eating the pith of the cane and eventually causing its destruction.

In our Entomological Report for 1873, Mr. Saunders gives a full, scientific description of the larva of this insect and many other interesting particulars to which we beg to refer the reader. Though certain that the girdling of the raspberry canes was caused by this insect, he states that he had "not yet seen the beetle in the act of depositing their eggs" and making the girdles. We are glad to be able to complete the life history of the insect by the account we have given above, which is taken from repeated observations that we made ourselves several years ago at Cobourg, the substance of which we embodied in an article in the *Canada Farmer* of 1869 (page 358). The object of this singular girdling operation is, in all probability, to check the growth of the cane, and so prevent the crushing and destruction of the egg or larva by the rapid increase of cells and tissues in the plant.

An obvious remedy for the injuries inflicted by this insect is to break off *at the lower girdle* and burn the affected twigs, as soon as possible after they are observed to wither; the egg or newly-hatched larva will thus be destroyed and the increase of the species checked.

In the foregoing description of the wood-boring beetles figured on our plate, our aim has been, not to write an original dissertation upon the insects, but to gather together from various sources, as well as from our own observations, all the information respecting them that we have thought would be of interest or value to the readers of these Reports. We hope that the beauty and graceful forms of the insects will lead many of our country friends to collect for themselves, and then study the life history of these wonderful denizens of our groves and forests.

THE APHIDES OR PLANT LICE.

By W. Saunders, London, Ont.

Under the common term aphis or plant louse is embraced a number of distinct species belonging sometimes to different genera, but all resembling each other so closely in appearance or habits as to lead to their being grouped under one common name. So closely do many of the species resemble each other, that their distinguishing features cannot be made out without the use of a magnifying lens. There are very few plants, shrubs, ornamental or fruit trees, but are more or less affected by these insects, and on many of them they luxuriate and thrive to such an extent as sometimes to threaten their destruction. These plant lice are not restricted to any part of a plant; often they are found on the leaves, but sometimes on the stems, or again on the roots of plants, while other species roll up the leaves, or form gall-like swellings on them. This troublesome tribe of insects holds a position in regard to the vegetable world, somewhat analagous to that of some well-known parasites on animals; hence the popular name plant lice. They belong also to the same great order of insects, *Hemiptera,* all of whom obtain their livelihood in a similar manner, viz: by suction. They are all furnished with a beak-like mouth, sometimes hard and solid, which is thrust into the plant or animal they are feeding on, and used to extract its fluids.

Plant lice are remarkable for their fecundity. People are often puzzled at finding their plants or trees swarming with plant lice, where a week or two before there was scarcely one to be found. As a general rule an aphis, during the summer season, reaches maturity in ten or twelve days from birth, after which it produces every day two young ones, which, contrary to the general rule with insects, are born alive. This rate of increase is maintained for a considerable period, from fifteen to twenty days or more; the young begin to produce in like manner in from eight to ten days, and so on through the third, fourth and sometimes up to the twentieth generation in one season. Some idea may be formed of the numbers which in a short time this rate of increase would produce, from a calculation of Curtis, a celebrated English Entomologist, who has computed that, from one egg only, there would be produced in seven generations, taking thirty as the average of each brood, the enormous number of seven hundred and twenty-nine millions, so that were they all permitted to live, everything on the face of the earth would in a short time be covered with them. Indeed, sometimes the possible rate of increase is even greater than this. Dr. Fitch, late State Entomologist of New York, has ascertained by actual experiment that in the case of the grain aphis, the wingless females become mothers at three days old, and thereafter produce four little ones every day, so that even in the short space of twenty days the progeny of one specimen, if all were preserved from destruction, would number upwards of two millions.

It may be urged in objection to these calculations, that no allowance is made for a certain percentage being males, but strange to say all through the summer there are no males born, but all are fertile individuals, giving birth to others, and these to others still, independent of any influence from the opposite. With many species, some individuals of each brood acquire wings, while others are wingless; the wingless ones remain, of course upon the plant upon which they were produced, while the winged specimens fly to other plants, where they establish new colonies. About the middle of September, the last generation for the year is produced, which consists of males and females, the males generally becoming winged On reaching maturity, the sexes pair, when the females no longer bring forth young, but lay eggs, which are able to resist the severe cold of winter, and these hatching in the following spring, produce mothers which bring forth their young alive. The individuals composing the late brood having provided for the continuation of their race, generally die on the approach of winter.

It appears that there are, however, exceptions to this general rule. In the case of the grain aphis, Dr. Fitch says that he has watched it the year round so closely that he is perfectly assured that no eggs were laid and no males produced, and he further states that in the autumn the mature lice continued to produce their young ones until they and their young became congealed upon the leaves of the young grain by the advancing cold of the season, and in this state they were buried beneath the snows of winter and with the warmth of the ensuing spring they were thawed and returned to life again. Professor Cyrus Thomas also found living lice upon young fall wheat in South Illinois in the middle of winter, and after much sleet and rain had fallen. Even so far north as Connecticut, Prof. Verral found numbers of wholly plant lice of all sizes on the branch of an apple tree so late in the year as December 11th, and this after two snow-storms and many cold rains and freezing nights. Indeed those who cultivate plants in their houses or otherwise under glass during the winter, will ot require much further evidence than their own experience to convince them that plant-lice, tiny, tender looking, and juicy as they are, are endued with such perennial vitality and hardihood as to require great watchfulness and frequent use of remedies for their destruction in order to keep them within due limits.

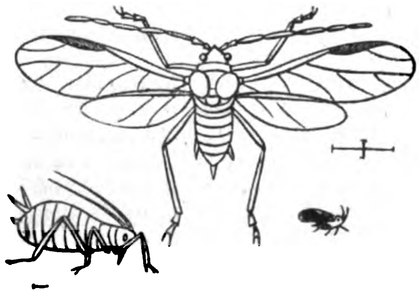


FIG. 4.

In figure 4 we give a highly magnified view of the apple aphis, *aphis mali*, both in the winged and wingless forms; the hair lines along side of the figures show the natural size of the insects. At the tip of the abdomen is seen a little projection; this is the oviposter or egg-laying instrument, and on each side of this is another little horn-like projection. These latter are called the honey-tubes, and through them a sweet liquid is produced which is sometimes discharged upon the leaves of the infested plant, which drying up, forms a sweet glutinous substance known under the name of honey dew. In olden times the origin of this honey dew was shrouded in mystery, and many theories were advanced by sage philosophers to account for the strange phenomenon. Pliny, the great Roman naturalist, hesitates whether to call this honey dew, the sweat of the heavens, the saliva of the stars, or a liquid produced by the purgation of the air. Thanks to the careful observations of entomologists, philosopners have no longer any reason to puzzle themselves as to its origin.

In this connection another strange feature deserves explanation. Most attentive observers will have noticed that where trees or plants in the open ground are infested by plant lice, they are also much frequented by ants who are busy running up and down the trunk or stem the whole day long. This association of the insects has led some to suppose that the aphides are in some way produced from the ants, and we have heard of various ingenious devices being resorted to, to prevent the ants from ascending the trees, under the idea that in this manner the aphis might be in some measure got rid of. A slight examination will suffice to show the fallacy of this view, and reveal the real objects the ants have in their visits. It is a well established fact, as most housewives know to their cost, that ants are very fond of sweet things. Examine closely one of the groups of plant lice which are being visited by the ants and you will see one or more ants walking about among them; applying a magnifying lense to the group, and you will presently perceive an ant drumming gently on the back of a plant louse with its flail-like antennæ until it coaxes the aphis to emit from its honey tubes a drop of the sugary liquid. This the ant absorbs and passes on to another, which is subjected to similar treatment, and so on until having filled itself, it descends to the earth and having regained its nest, discharges the sweet fluid into the mouths of the helpless maggots, the larvæ of the future ants, which are entirely dependent for their sustenance on these industrious, working ants. Linneus, one of the earliest entomologists, and a most careful investigator, truly observes, "the ant ascends the tree that it may milk its cows, the plant lice." These honey tubes are shown more prominently in fig. 5, which represents a wingless aphis.

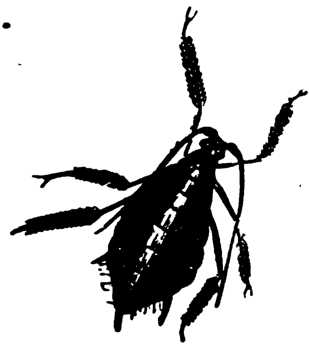


Fig. 5.

That the ants value their useful cattle, and carefully watch over them, there is abundant evidence ; they regularly visit them for the purpose of milking them, and, according to Dr. Fitch, " some of the ants remain constantly by them night and day to protect these small, weak creatures from being molested by their insect or other enemies. Thus, before we are able to inspect a colony of plant lice, we are first obliged to brush off or destroy the ants which are guarding them." The late Dr. Walsh says, "It is certainly true that the ants, if they can help it, will not allow any winged fly to visit their milch kine, being probably afraid that such flies come to rob them of the sugary fluid in which they take such delight. Thus, unconscious of what they are really doing, they often drive off Ichneumon flies, that would otherwise deposit their eggs in the bodies of the plant lice, and thereby cause their death, and *Syrphus* flies that would otherwise lay their eggs among the plant lice. But I have repeatedly seen them gathering in crowds round one of the fat fleshy aphis-devouring larvæ of the *Syrphus* flies, pulling him about in every direction, as if to ascertain whether he had got any honey in his body, like their friends the plant lice, and then, having apparently satisfied themselves that the fat gentleman was not in the grocery business, and not knowing that he butchered daily hundreds of their honey-producing friends, turn away in despair, and leave him, unharmed and unwounded, to his own devices, as a hard case that nobody could make anything of. It is apparently for the same reason, namely, to prevent sugar-loving flies from robbing them of their own private and peculiar honey dew, that ants occasionally construct a kind of tent round a little flock of their plant lice, but only where those plant lice are located on a twig, and never, so far as I have observed, where they are located on a leaf."

Notwithstanding all the care the ants may take to repel intruders, thousands of flies share in the sweets produced by the plant lice, and often the location of a colony of these insects, which would perhaps otherwise escape observation, may be detected by the loud buzz occasioned by the disturbance of the attending flies.

But there is seldom a rule without its exception, and while the details given above apply correctly to hundred of different species of plant lice, yet in the case of the grain plant louse, *Aphis avenae*, although the honey tubes are well developed, yet they emit no honey, and in consequence of this, as has been remarked by Dr. Fitch, this species is not attended by ants. To use the words of the late Dr. Walsh, " as this peculiar breed of cows gives no milk, the milk maids do not think it worth while to visit them.

Having now given our readers same idea of the general habits and immense fecundity of these interesting insects, we shall refer in some detail to a few of the most troublesome and destructive species reserving what we have to say in regard to the remedies which nature has provided or man invented for their destruction until we have completed the enumeration.

THE APPLE-PLANT LOUSE (*Aphis mali*).

This insect which is represented in fig. 4 is the same as that which similarly infests the orchards in Europe and has doubtless been introduced on the trees imported into this country from across the Atlantic. The insects of this species of the previous year deposit in the fall in the cracks and crevices of the bark of the apple tree large numbers of their small oval black shining eggs. A large proportion of these are dislodged by the cold, driving rains and snows of winter, and destroyed ; doubtless also, multitudes are devoured by the smaller insectiverous birds. The survivors hatch quite early in spring before the buds are fully expanded, when the young lice locate themselves on the small, tender leaves displayed by the bursting bud, and there inserting their sharp leaks into the tissues of the leaves, pump out their juices. The wingless specimens are of a pale, yellowish, green colour with a yellow head and black eyes and are less than the tenth of an inch in length. The winged specimens have the head antennæ and thorax black, and the body green.

THE APPLE-ROOT PLANT LOUSE (*Eriosoma pyri*).

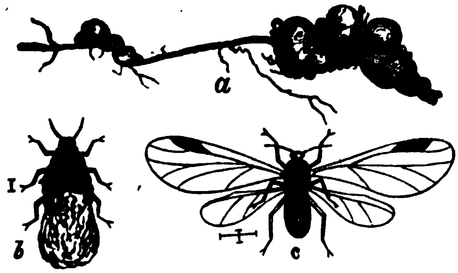


Fig. 6.

This species is a woolly louse which works under ground and produces upon the roots of the apple tree swellings or excresences (see fig. 6, a) of varying shapes and sizes; diseased growths which interfere seriously with the free circulation of the sap, an interference which often results in the death of the parts involved, and sometimes when these insects are very numerous their united efforts will occasion the death of the tree. In the more northerly parts of the Northern States this pest is very abundant and with us it is rare to receive a lot of young apple trees either from our own nurserymen or from those of the United States without finding some of them thus affected.

The mature louse (fig. 6, b) is about the tenth of an inch long including the closed wings of a dull colour with transparent wings and black legs, and with a peculiar downy or frosted look produced by the exudation from its body of a bluish white, cottony matter by which character it can often be readily recognised. When the wings are expanded the insect measures nearly $\frac{3}{16}$ths of an inch, (fig. 6, c).

As this species, situated as it is under ground requires diffierent methods of attack from those which infest the leaves of plants and trees we will refer to them here. The only artificial remedy yet suggested for the destruction of this pest is hot water used plentifully so as to scald the roots, or, at least, the larger ones over their entire area. To accomplish this successfully, it will be necessary to carefully remove the earth from about the surface of the roots so as to lay them bare. No danger need be apprehended from using the water scalding hot as the application has often been made without injury. This remedy is not so applicable to large trees as it is to young trees in the nursery row or those lately planted. As a preparatory measure, mulching the tree has been recommended, which brings the insects nearer to the surface where they can more readily be reached by the hot water.

Nature's remedies are, however, in this instance, probably more effectual than any which man can devise. In the first place, these lice are subject to the attacks of a very minute parasitic fly; and secondly, they are destroyed by the larva of the "Root-louse Syrphus Fly," *Pipiza radicans*, fig. 7 (after Riley). This latter friend is a fat, footless grub, fig. 7*a*, which lives underground among the lice and devours large numbers of them; in the fall it changes to a chrysalis, fig. 7*b*, and appears in the perfect form as a fly, fig. 7*c*, in the following spring.

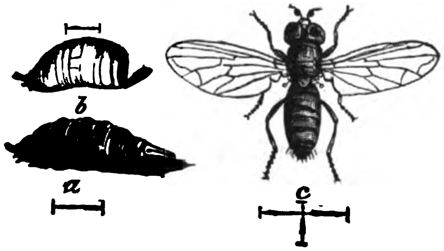


Fig. 7.

THE CHERRY-PLANT LOUSE, *Aphis cerasi*.

Probably no species of tree is so regularly infested by aphides as the cherry, and no species included in this large family of pests is more disgusting in appearance than this cherry-plant louse, for, while most others are of a more or less lively green colour, this is nearly black.

These insects begin to appear soon after the leaves have expanded, hatching from eggs deposited the previous year. They multiply with amazing rapidity, the young ones hud dling around their parents so closely as to entirely cover the twig, leaf-stem, or portion of the leaf on which they are feeding; indeed it is not uncommon to find them two deep, a portion of the crowded host standing upon the backs of others, all intent on the one business namely, that of absorbing the juice of the tree, which they do by inserting their beaks into the succulent portions. They seem never to suffer from over-crowding. Dr. Fitch estimates—his calculation being based on actual count—that the two surfaces of a small leaf, but an inch long, would furnish ample space to accommodate a thousand of these insects.

When we consider the rapid rate of increase which prevails among the aphides, some details of which we have already given, it is not astonishing that the leaves, leaf-stalks, tender twigs, and even the fruit-stems are so soon found to be swarming with these pests, their black bodies literally covering every succulent portion, while all around flies, wasps, and other insects are swarming, keeping up a constant buz and hum about the infested tree, to which they are attracted by the sweet liquid which exudes from the bodies of these aphides. By the end of June they have usually attained their maximum numbers, for by this time their numerous enemies, which we shall hereafter refer to more in detail, have become so multiplied as to begin to get the better of them, and when once the scale is turned against them they are sometimes destroyed so rapidly and entirely that in a few days not a living specimen can be found, the empty skins of the slain being the only remaining relics of the vast hordes but recently seen. Dr. Fitch well remarks, "It is by looking at the works of nature in a definite manner, aud tracing out her operations specifically and in their minute details that we arrive at some faint conceptions of their magnitude and grandeur, and become vividly impressed with the truth that no other agency than that of a Creator infinite in wisdom and power could have peopled the world which we inhabit with such countless numbers, and such an endless variety of objects animate and inanimate, each occupying its appropriate sphere, and all so arranged as to fulfil the objects for which they were called into existence. Has the reader as he has passed a forest ever attempted to conjecture the number of trees which it contained? and has his mind passed onward to a surmise of the probable number of leaves growing upon each tree, and onwards still to the number of insects which may be drawing their sustenance from each one of these leaves; and still further to the number of minute and infinitesimal parasites which may be subsisting upon these insects?" Such reflections could scarcely fail to lead the thoughtful observer "from nature up to nature's God."

During July the cherry tree generally enjoys some respite from the attacks of these tiny foes, but early in August they usually appear again to increase and multiply until being again overtaken by their enemies they are a second time overcome, this later brood is seldom as numerous as the first one. This black aphis seems to be restricted to the cultivated cherry, for we never find them invading any of our native or wild cherry trees, and these in turn seem each to have a species of plant louse peculiar to them, which seldom if ever attach themselves to the foliage of other kinds. Dr. Fitch has described in his first report on the noxious insects of New York, a green species *Aphis cerasifoliæ* which affects the undersides of the young and tender leaves of the choke cherry, and refers to another which infests the wild black cherry.

Thus we might go on enumerating and describing species after species to the exhaustion of the patience of our readers, for there is scarcely a tree, shrub, or plant, which is not at some period or other in the year infested with them. We would, however, particularly mention the currant plant louse *Aphis ribis*, which swarms on our currant bushes, and which has probably been imported into this country from Europe; the Cabbage-plant louse *Aphis brassicæ*, also introduced from Europe; the Hop-plant louse *Aphis humuli*, and the Grain-plant louse *Aphis avenæ*, since these from their great abundance frequently attract general attention.

We now propose to refer to the remedies which nature has provided, and man has devised for the destruction of these tiny foes, and beginning with the more important and most effective, we shall first advert to the natural enemies of the plant lice. It has been truly said, "the plant louse has but one friend—the ant, but its enemies are legion; and wisely is it so arranged, for were they permitted to increase and multiply at their natural rae without material check, ere a few months had elapsed every green thing on the face of the earth would be so covered with them as to cause general destruction.

Foremost in the list of enemies we must place the lady-birds which feed on little else than aphis either in the larval or perfect states. Probably the commonest species is that known as the nine spotted lady-bird *Coccinella 9 notata* fig. 8, a nearly round insect, of a brick red colour, with nine black spots, fig. 9, shows the same in the larval condition. Another common species is the two spotted lady-bird *Coccinella bipunctata*very similar in form and colour to the previous species, but smaller and with two black spots instead of nine. The spotted lady-bird *Hippodamia maculata* fig. 10, is also frequently met with, and being found both in Europe and America has probably been imported from one country to the other. The colour of this is pink withlarge black spots. The thirteen spotted lady-bird *Hippodamia 13 punctata* fig. 11, is rather larger than either of the preceding species and has thirteen black spots on a brick red ground. The trim lady-bird *Coccinella munda*, Fig. 12, may be readily distinguished from most of the other species by its having no black spots on its red wing cases. The convergent lady-bird *Hippodamia convergens*, Fig. 13, is of a deep orange red colour, marked with black and white. Its larva *a*, is blue, orange and black in colour, *b*, shows the pupa or chrysalis suspendep by the tail, and *c*, the perfect beetle. This insect is also very useful in destroying the eggs and young larvæ of the Colorado potato beetle.

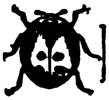


FIG. 8.

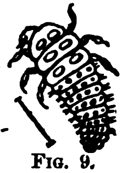


FIG. 9.

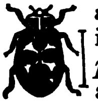


FIG. 10.

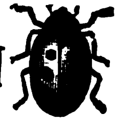


FIG. 11.

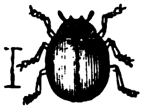


FIG. 12.

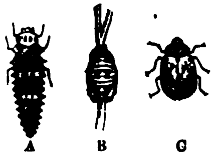


FIG. 13.

The fifteen spotted Mysia, *Mysia* 15 punctata, Fig. 14, is one of the largest species. The perfect insect varies much in colour from a light grey to a deep chestnut brown. An ordinary observer might readily conclude that the different forms belonged to those of distinct species, the more prominent of these variations are shown at *d*, *e*, *f*, *g*, in the figure. This predacious species also devours the young of the Colorado beetle, at *a*, the larva of thislady-bird is represented in the act of devouring one of these young enemies. In addition to those we have enumerated, there are a number of other less common species, in colour mostly yellowish or reddish with black spots or bands. In the larval state they all resemble each other very much, being elongated in form and active in habit, usually of a dull colour withmore or less yellowish or bluish markings. Fig. 9 may be referred to as a type of the whole.

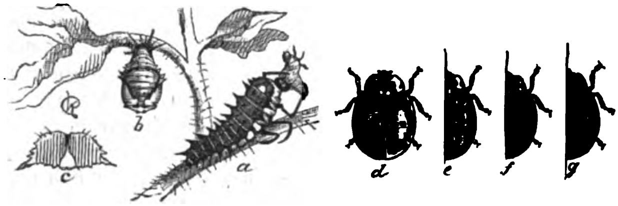


FIG. 14.

There is still another species, belonging to another genus of lady-birds, which, from its abundance and great usefulness deserves mention, we refer to the twice-stabbed lady-bird *Chilochorus bivulnerus*, Fig. 15, a highly polished black insect with two red spots, and which in form much resembles the half of a split pea. This species preys more particularly upon bark lice, and hence is most commonly found on the trunks and branches of trees. The larva, Fig. 16, is a verycurious, prickly looking creature, extremely active and voracious in its habits. Its chrysalis may often be seen on thetrunk of trees partly covered by the prickly larva skin.

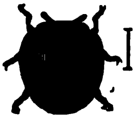


FIG. 15.

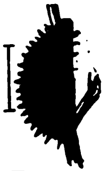


FIG. 16.

Prominent also among the insects which subsist upon plant lice, are the aphis lions, the larvae of the golden-eyed and lace winged flies. The perfect insects are very pretty and delicate-looking creatures, with prominent fiery eyes, slender bodies, and two pairs of large, beautifully netted, pale green wings Many of them, however, when handled, impart an intensely disagreeable odour to the fingers, and one of a remarkably permanent character, Fig. 17 represents this insect in theperfect state.

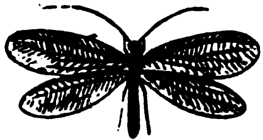


FIG. 17.

The eggs of this insect are curiously placed upon stalks as shown in Fig. 18. Dr. Fitch says, "Nature has furnished these insects with a fluid analagous to that with which spiders are provided for spinning their webs, which possesses the remarkable property of hardening immediately on being exposed tothe air. When ready to drop an egg, the female touches the end of her body the surface of the leaf, and then elevating her body, draws out a slender and cob-web-like thread half an inch long or less, and places a little oval egg at its summit. Thus a small round spot resembling mildew is formed upon the surface of the leaf from the middle of w hich arises a very slender glossy white thread, which is sometimes split at its base, thus giving it a more secure attachment than it would have if single. The egg at its summit is of a pale green colour when newly deposited, but before it hatches it becomes whitish and shows two or three faint dusky transverse bands. The larva leaves it commonly I think in less than a week from the time it is deposited, through an opening which it gnaws in the summit, and the shell remains empty supported on its stalk, somewhat shrivelled and of a white colour.

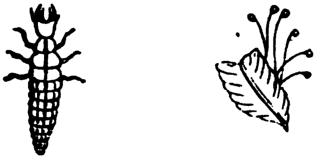


FIG. 18.

The young larva begins at once to seek its food, and if it finds itself in the midst of a colony of plant lice, many of these speedily fall victims to its enormous appetite, but if not so favourably situated, a vigorous search is generally rewarded by the finding of a cluster of insects' eggs or some newly hatched catterpillars, either of which will furnish our young traveller with a dainty meal. The larvæ of the different species vary somewhat in colour and ornamentation, but in most instances the ground colour is of a dull reddish brown, and there are whitish markings along the sides, and a dark central stripe. They all have long, narrow bodies, and are furnished with six rather long legs, and two long and slender, but powerful jaws curved like a sickle, and down each side of the body is a row of tubercles, each tubercle being tipped with a cluster of spreading hairs or spines. Fig. 18 will give a good idea of their general appearance. In some species the bristly clusters of hairs are so multiplied as to almost cover the surface. Dr. Fitch mentions a novel use to which these hairs are put, he says that these voracious creatures aften conceal themselves from view by placing the empty skins of the victims they have devoured, between their radiating bristles so that they adhere and thus completely hide the insect from view. It is the skins of the woolly plant lice that they mostly employ for this purpose, and thus covered they resemble a little mass of white down adhering to the bark of the tree, presenting just such an appearance as does a little colony of woolly plant lice. By this device they are enabled to approach their victims without exciting their alarm and to quietly devour them one by one.

After acquiring full growth the ant-lion having made a hearty meal, remains for a time torpid, and then begins to spin its cocoon, which is formed from a glutinous fluid supplied and distributed by the hinder extremity of the body, a fluid which hardens as it is spun into threads. In a few hours the insect spins enough of its cocoon to hide itself from view, and when completed the threads composing the cocoon are so closely compacted as to give the surface a papery look. During the operation the larva contracts much in size and bandages itself so tightly within its enclosure that the cocoon appears very small in comparison with the size of the larva constructing it. Here the insect changes to a chrysalis of a pale green colour and remains in this condition in summer a fortnight, but if the insect belongs to the later brood, it remains in the chrysalis state all winter, appearing as a perfect fly the following spring.

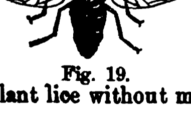


Fig. 19.

Other enemies to the plant lice are to be found among the larvæ of the various species of Syrphus flies. These flies vary in size, some being smaller, others larger than the common house fly, and usually more slender in form, they are also handsomer, their bodies being of a bright yellow colour, banded and spotted with black. Fig. 19 represents one of the species. They are very swift of flight, darting about with great rapidity, again hovering with poised wing in the bright sunshine, or alighting upon flowers These flies place their eggs singly, fastening them to a leaf or twig infested by plant lice, usually placing them in the midst of a colony where the young larvæ may not have long to search for appropriate food. One cannot go far in summer in the careful examination of groups of plant lice without meeting with those small white oval eggs. The young larva when hatched is not unlike a leech, both in appearance and movements. Having no eyes, it appears to be placed at a great disadvantage in the search for food, but fixing the hinder extremity of its body to the surface on which it is placed, it reaches as far as it is able to stretch first on one side, then on the other. If no food is reached, it moves a little further, and then repeats the same motions, and so on until it reaches a plant-louse, when at once it seizes its prey, holding it up in the air, as shown in fig. 20, until having sucked it empty, nothing remains of the louse but a shrivelled skin, and all this occupies scarcely more than a moments time ; indeed it has been asserted that a medium sized larva will thus consume a hundred plant lice in an hour. These larvæ are semi-transparent, so much so that the movements of some of the internal organs are plainly discernible through the skin in one of the larger specimens. Their usual colour is whitish or greenish, with white, yellow or dull reddish markings, or with a combination of these down the centre of the back. When they have completed their growth, they fix themselves to the surface of a leaf or a piece of bark and contract themselves to an oval form, which gradually becomes hard and horny, and of a blackish colour, and within this shell the change to a chrysalis takes place, and in due time, from it the perfect fly escapes.

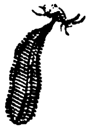


Fig. 20.

But the aphis has foes which attack it from within, as well as from without. Almost all insects are infested more or less by parasites, and the aphides are no exception to this general rule. There are several genera of tiny parasites which thus befriend man, all of which are included in one group named *Aphidiides*. Dr. Fitch's remarks on this interesting group are so much to the purpose that we quote them entire. He says: " These are all exceedingly small insects, little exceeding the twentieth of an inch in length, and mostly with black bodies, variously adorned with bright tawny yellow, and pale sulphur yellow bands and other marks. One of these small Ichneumon flies, resembling a winged ant in appearance, may occasionally be discovered busily at work among a colony of aphides. With her long thread-like antennæ stretched out in front of her, and rapidly vibrating, she approaches an aphis and touches it gently, much like an ant when nursing these creatures. By this slight touch, she at once ascertains whether the aphis has been previously visited. If it has not, she curves the tip of her abdomen forwards under her, puncturing the body of the aphis and inserting an egg therein. She then passes to another and another. From this egg hatches a minute worm, which resides within the aphis, subsisting upon the juices which the latter extracts from the plant. Thus it grows with the growth of the aphis, which furnishes the exact amount of sustenance which the worm requires for bringing it to maturity. It is singular that the parent Ichneumon fly knows if two eggs were deposited in the aphis the worms from them would die for want of a due supply of food, and that by a mere touch with her horns, she is able to ascertain which individuals have already been impregnated. Some of the species of Aphidius are larger than others, and their offspring consequently require a larger quantity of food ; but each parent has the instinct to select an aphis of such size as will yield the amount of sustenance which its young requires.

" By the time the worm has attained its growth, the aphis becomes so exhausted that it dies. If it should now drop from the leaf to the ground, it would be liable to be found and devoured by centipedes and other insects which feed upon the carcases of animals of this class, and thus the worm within it would be destroyed. Nature has, therefore, so constituted the aphis that in these circumstances it dies without a struggle or a spasm, with its beak inserted, and its claws clinging to the surface of the leaf, standing with its antennæ turned backwards, and its whole aspect so life like that in the infancy of my studies, I supposed these were one of the varieties natural to the species with which they occurred. Their bodies are remarkably plump and smooth, commonly clay-coloured, or the hue of brown paper, and the aphis lions and other insects, which destroy the aphides, appear to pass by those which have these parasites within them. Hence, where a leaf or twig has recently been cleared of plant lice by their enemies. several of these ichneumonized individuals may frequently be found remaining upon it, dead and unmolested. In other instances, the whole colony of aphides appears to be exterminated by these parasites alone, the dead swollen bodies of their victims covering the surface of the leaves or twigs as closely as they can stand. The worm remains within the body of the dead aphis during its pupa state. It then cuts a circular hole through the dry hard skin, and comes out in its winged and perfect form."

" These parasitic insects, which feed internally upon the aphides, are as efficient in destroying them as the aphis-lions or any other class of their enemies. And it is truly wonderful, that whilst every kind of tree and plant appears to have one or more species of aphis infesting and blighting it, each species of aphis seems to have a particular parasite preying upon and devouring it; for each kind of aphis, from which I have reared these insects, has furnished a species differing from all the others, and, in some instances, two species have been obtained from one kind of aphis."

How complicated and how wonderful are the marvels of Nature. There seems a providence in all these arrangements. Kirby has well said that it is strange that among the innumerable species of insects, many of them extremely fragile and exposed to dangers and enemies without end, no link should be lost from the chain, but all be maintained in those relative proportions necessary for the general good of the system; that if one species for a while preponderate and instead of preserving seem to destroy, yet counter-checks should at the same time be provided to reduce it within its due limits; and further, that the operations of insects should be so directed and overruled as to effect the purposes for which they were created, and never exceed their commission; nothing can furnish a stronger proof than this, that an unseen hand holds the reins, now permitting one to prevail and now another, as shall best promote certain wise ends, and saying to each "Hitherto shalt thou come and no further."

A few words will suffice to indicate the remedies which man has devised to lessen the numbers of these destroyers of vegetation. It is universally conceded, that where the remedy can be conveniently applied there is nothing more effectual than tobacco smoke. To exterminate them in green-houses, smoking—by strewing a few leaves of tobacco on hot coals—is regularly resorted to, and, if thoroughly done, is very effectual. A few favourite plants may be similarly treated by enclosing them in a light paper-covered frame and smoking under it, or by placing them under an inverted barrel or box; after such treatment the plants should be immediately washed with luke-warm water from a syringe or watering-pot. Where this remedy cannot be applied, drenching with tobacco-water has been recommended, also the application of strong soap-suds, or weak lye, sprinkling it freely on the plant, and even dipping the succulent ends, where the aphides cluster, into the liquid.

Hot water has also been recommended, but this, if not cautiously applied, is very apt to injure the plant. Some species will bear an application of water heated to 130° Fahrenheit, indeed, some few will bear a higher temperature than this without injury, but others are more susceptible in this respect, hence the remedy requires careful handling.

REPORT

ON

SOME OF OUR FRUIT INSECT ENEMIES,

FOR 1877.

BY B. GOTT, ARKONA, ONT.

It was with much pleasure and satisfaction that I was able to be present for the first time at our Society's annual meeting, last September, in London, Ont., I then and there imbibed deeper and wider ideas of the extent and importance of the work in which our entomologists are so ardently and devotedly engaged, I also had an opportunity of personal acquaintance with the characters and qualifications of the men who are the foundation and the noble pillars of the Society. The men then present were practical and intelligent, and the earnest sympathy they showed in the work and objects of the Society, could not be otherwise than encouraging to those engaged in this interesting and serviceable study. It is not easy to conceive how any people possessing and supporting such a Society, whose work and results are so palpable to the masses, can be otherwise than progressive; and as far as their productive results are concerned, every way prosperous. Should we not desire that the effective membership of the Society may largely increase, and that thus the educating and elevating influences of the study may be extended, and felt to be not only an assistance but a powerful helper of the people through the length and breadth of the land. In my own individual case I find my interest in the subject of entomology annually deepening and widening in proportion to the extent in which my attention is directed to it. Since being engaged to some extent as I have been for the last few years in the critical but interesting production and cultivation of fruit in this western part of Ontario; I found from the very start that something more was necessary to success than a mere knowledge of the theory of production. I found insect enemies to contend with, for which, in my ignorance, I had made but little or no provision. My combativeness was at once aroused; but finding progress in a hand to hand fight very slow, and not very encouraging or satisfactory, I began to reflect that prudence was the better part of valour, and I at once set myself bravely to the task of arriving at some knowledge of their differences, their habits, their possible numbers, and their possible use; with also some data for successful competition. I have not advanced far, but I soon found that my opportunities, my samples and specimens were not scarce, especially in our summer and growing season, and that their differences and peculiarities were very interesting, and their numerical forces sometimes appalling. Some were feeding voraciously on a specific plant, shrub, or tree, or on a class of these; and others were feeding as voraciously on their opposites. Some were most injurious and destructive in their immature state, and others needed the complete forces of maturity to do the same amount of effective execution; some were most active in their destructive work on the roots in the ground, some were content with the leaves, and yet others were satisfied with nothing of less value than the fruit. So I concluded that insect depredators were not wanting more or less for everything that grows. It would almost appear too, that we have peculiar local insect troubles, as though special and individual classes of insects were localized and restricted to sectional divisions; but by further acquaintance with the subject, I must suppose this can hardly be. However, it is beyond dispute, and capable of most positive and convincing proof, that in this department of natural research there is much to be studied and much to be learned; there is ample and profitable room for the intellect, and investigation of the most vigilant and the most penetrating.

Moreover, what abundant cause have we for gratitude and thankfulness to those patient, honoured, and great names whose owners have worked hard and long, and spent their valuable and industrious lives in this interesting field of inquiry, and have freely left us, as a legacy, the cherished results of their labours—"their works do follow them,"—and we are thereby assisted in those difficult and puzzling problems of insect life and insect differences and relationships; and although there is yet much to be done, much has already been accomplished and vividly portrayed before our vision. The field has already been surveyed and mapped, and it only remains for us to follow those lines to arrive at rich and desired results. I propose, therefore, in the following pages, to give as short and concise an account as possible of some of the most palpable insect enemies of our fruit, &c., for the past season. And this I do, not with the intention to supplant the able and graphic report of insect enemies by the President of the Fruit Growers' Association, in his address before that body last September; or of that of the President of the Entomological Society, at about the same time, but rather as an adjunct additional testimony in the same direction. I further may be allowed to state that I make no pretentions to scientific accuracy, but shall simply state my observations as they occur to me in my own untutored way. With these preliminaries I come at once to the subject in hand, viz:—

The insect enemies of our Fruits, &c., for 1877.

By this caption I do not mean that I shall confine myself exclusively to those insects merely which feed alone on our fruits, but shall include also those injurious to the leaves and even the roots and branches of our fruit trees and shrubs, as equally noxious to our fruit products and prospects. And first, I may mention the

AMERICAN LACKEY WORM, OR TENT CATERPILLAR (*Clisiocampa Americana*)

Of Harris. For larvæ and eggs see fig. 21; the male moth is shown in fig 22, the female in fig. 23. This insect, by its appalling and unprecedented numbers, and by its voracious and devastating habits, at least in this section, for the last few seasons, has filled us with the most serious apprehensions for the safety of not alone our fruits, but also for the very life of the trees. So serious was this damage during the past season that the aid of legislation was talked of, to compel people to do what they could for the suppression of this insect grievance; because not only the orchards of the negligent and careless were thus blighted, but those also of the industrious and careful were besieged and destroyed by the very enemies his careless neighbour was rearing and helping to propagate. People began to ask of one another, "What is the use of planting and cultivating orchards, they will only be devoured and ruined by the caterpillars?" Aided also by *C. Sylvatica*, the larva of which is shown in fig. 24, those orchards standing in the neighbourhood of forests have suffered very severely; and although persistent and industrious, our efforts seem feeble and almost totally unavailing to save our orchards and our gardens. This latter insect is very active, and is on constant parade over trees and shrubs, over fields, orchards, and gardens, where anything can be found to gratify its devouring appetite; and then, it is recruited so plentifully and so frequently that we fairly sicken of the fight, and despair of the prospect of victory. But there is to this dark picture

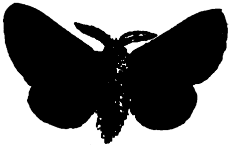


Fig. 22.

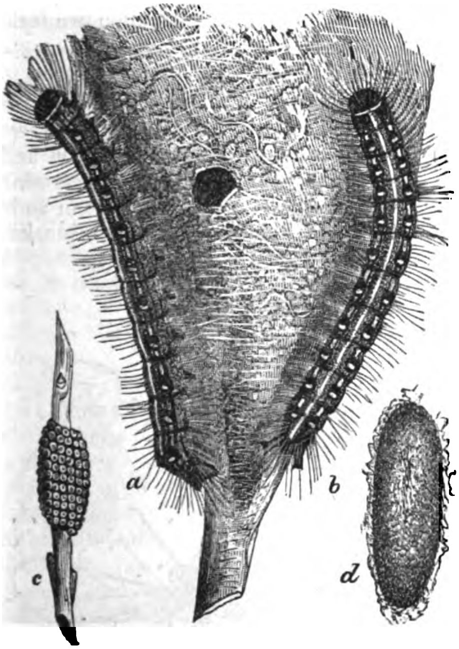


Fig. 21.

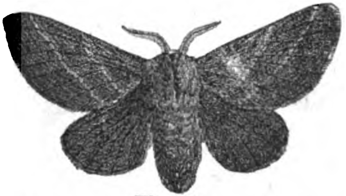


Fig. 23.

Fig. 24.

a cheering ray, a bright prospect of assistance, from a small ichneumon fly. On examining a number of the cocoons of *clisiocampa*, as they were safely nestled in the folded fragments of leaves left on the trees, we found a large proportion infested with maggots or small white grubs. These we found were of two or three distinct sorts; one was a largish white grub, and existed in the body of the caterpillar, sometimes solitary and sometimes in pairs, and entirely devoured the internal portions; and in other cases they were smaller and closely huddled together, but in each and every case the destruction of the caterpiller and of the future egg-laying moth was most complete.

Our methods for suppressing this grievance and lessening their numbers were not very effectual, but consisted in entrapping the moths by means of light, and in taking their egg clusters from the branches of the trees and destroying them. As soon as the young larvæ were hatched in the spring our practice was, as early as possible in the day, while they were yet very young and closely compacted, to collect them in masses and destroy them. In this way millions were easily and effectually captured and destroyed, but there are always some careless neighbours who would do nothing, and declare it was of no use fighting them as they would eat up the trees anyway, and so by swarming in from the forests, and those neglected orchards, the trouble was annoyingly kept up.

MEASURING WORMS (*Geometers*) AND LEAF ROLLERS, (*Tortrices*)

were this year, as usual, very abundant on all our fruit and ornamental trees, shrubs and plants, but the diligent overseer, by his watchfulness and skill can, with comparative ease, so reduce these troublers that their work on the mass of foliage is scarcely perceptble. The only way they seem to us damage, and in which we feel them to be a burden is as assistants combined with the already multitudinous forces in the same field of destruction, we feel that we could readily do without their services.

THE CURRANT BUSH BORER (*supposed to be the European Aegeria Tipuliformis*, See fig. 25.)

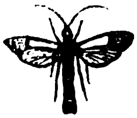


Fig. 25.

is doing us considerable damage in our currant plantations, and here, too, this evil is permitted by the careless and indolent cultivators to increase upon us, so that eventually, currant growing in this country will become very uncertain and very troublesome. These insects eat out the heart of the young stem and so weaken it that it is incapable of ripening its fruit and shortly dies or breaks off. Of far more serious moment at present, however, is

THE CURRANT OR GOOSEBERRY WORM (*Nematus Ventricosus*).

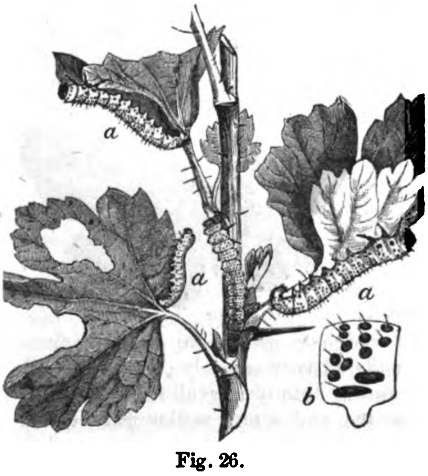


Fig. 26.

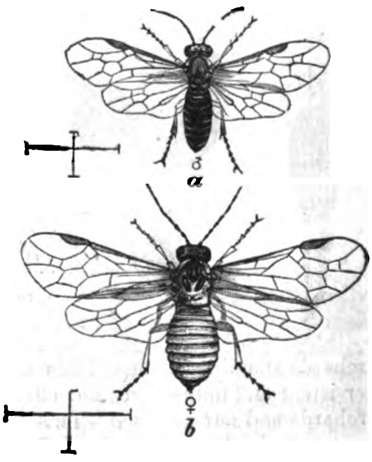


Fig. 27.

The larva of this pest is seen in fig. 26. The perfect fly, male and female, fig. 27; and the eggs as laid on the leaves in fig. 28. This abundant and voracious insect feeds readily in the larval state either on the leaves of the currant or those of the gooseberry, but I prefer to call it by way of distinction, the *Currant Worm*, and the insect that feeds on the fruit of the goose

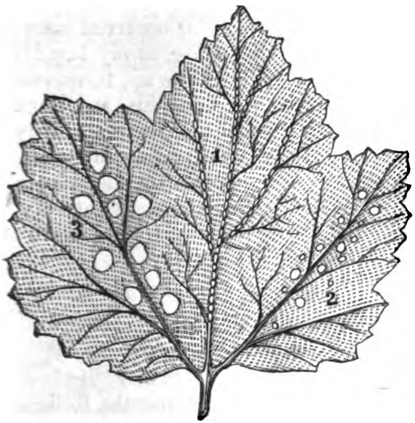


Fig. 28.

berry and currant, the *Gooseberry Worm.* This insect is very common and very injurious and has been for many years past, and in all parts of the country, so that a description is needless as all are thoroughly familiar with its appearance and its work. It is felt to be such a severe scourge, however, and so discouraging in its effects upon us that it has very sensibly, suddenly and effectually checked the production of this refreshing summer fruit. We seem to be helpless in the matter and have little or no respite for the incessant attacks upon us of several broods in one season, will effectually, baffle the most determined and the most industrious. Our readiest and best remedy is applying powdered *White Heelebore* to the surface of the leaves which is a temporary relief as it does not agree with the best functional interests of their insect-constitution. But the thought of poison among our summer fruits is rather appalling, and not of the most relishable or attractive character.

THE GOOSEBERRY FRUIT WORM (*Pcmpelia Grossularia*).

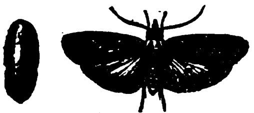


Fig. 29.

For a representation of the moth and cocoon of this species, (See fig. 29). This is, perhaps, the most insidious and annoying enemy of the gooseberry and the currant. It winters as a chrysalid near the surface of the ground just under the bush where it was last feeding. In the early spring as soon as the sun has warmed the soil the active and vigilant moths appear, and after copulation, commence at once their work of egg depositing in the young fruit almost before the full and proper expansion of the blossoms. These eggs quickly give rise to little white, insidious worms that make their way into the very heart of the berry and grow and thrive upon its internals. As soon as this berry is consumed and unable, longer, to serve the worm any good and substantial purpose, it leaves and immediately attaches itself to another by means of its silken cords or web-like productions, and thus secures itself safely against all danger and loss. In this way it has attacked and destroyed a dozen or more berries to satisfiy its cravings before it has reached the period of maturity or the season for change. When this period arrives it falls to the ground by means of its silken threads, buries itself in the earth and changes to a chrysalis. The remedies are hand-picking, and the application of noxious substances to the bushes in early spring, but these are troublesome and partly ineffectual and hence not very satisfactory.

THE MAY BEETLE (*Phyllophaga Quercina.*—See Fig. 30).

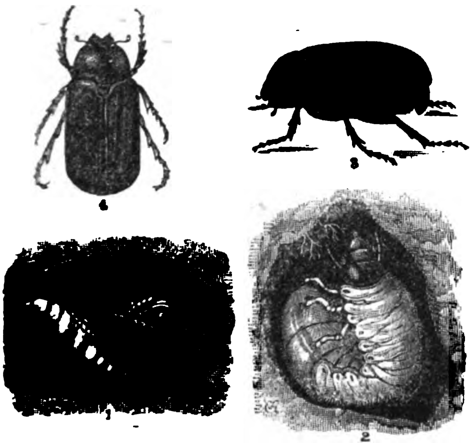


FIG. 30.

2 represents the larva, 1 the chrysalis, and 3 and 4 the perfect beetle. The larva of this active summer evening buzzing beetle stands charged with many and grievious offences against the farmer and the fruit grower. A neighbour of mine said to me the other day "My corn was only half a crop—those cussed white grubs eat it so; it wilted to the ground;" but I suppose that in his case, perhaps, something else did it. However, although our soil is peculiarly suited to their purposes, and is liberally supplied with the larva in all stages of growth. I have but one or two heavy grievances to lay to their charge, one of which I feel pretty deeply and severely. I had long noticed, after planting out young evergreens in nursery rows in the spring, particularly seedlings of spruce, hemlock, and fir, that occasionally several of them just after commencing

their growth would suddenly wilt and at once give up; and this Spring this occurred more extensively than ever. I was in difficulty and could not decipher the cause, as my land I knew was good and well adapted to their successful-growth. Upon pulling them up, however, I found that every particle of fibrous root was entirely gnawed off; and besides this, the bark was taken off almost up to the collar, and the tough naked woody branches of the roots only left. This last season I lost whole rows in this way, and, on closely investigating the case, I am pretty well satisfied that the larvæ of the May Beetle are chargeable with the whole trouble; and worse, I know of no remedy! The other charges are, eating the roots entirely off from several of our strawberry plants, and also eating large and injurious holes in our potatoes, &c., &c.

THE HAWK MOTH, OR *Sphinges*

are growing annually more numerous, but we have no very grievous complaints to make against the fine and handsome larvae of these beautiful moths. Occasionally, however, the foliage suddenly disappears from some branch of our apple trees or our cherry trees, or it may be from our grapes or our potatoes, or perhaps from the tomato vines, and we know from the character and the abundance of the surrounding droppings that one or more of these diligent creatures has been at work. These ravages, however, are not burdensome, and then we readily bear with much from them solely on account of the magnificence and grandeur of their characteristic appearance. About the second and third weeks in October last there were a number of fine larvæ discovered among the grass and late growing green plants in this place. They were about two and a half or three inches in length, fine green colour, mixed and striped with yellow; had the characteristic horn on the last segment, and would curl up as a crescent on being disturbed. I could not determine it, but I have reason to believe it was one of the sphinges.

CUT WORMS.

With these I sometimes conclude that the very earth is infested, so great are their numbers and so active their operations. There are evidently many species of them, but the worst and by far the most dreaded is the sneaking thief that cuts our cabbage and tomato plants after they have commenced to grow so finely.

AGROSTIS DEVASTATOR

of Harris, and very correctly labelled. These are the most insidious in their attacks, and the most annoying in their devastations, apparently, of any of our garden enemies, and we seem powerless in our defences. They are the most industrious while we are asleep, and like many another dastardly thief hide as soon as the light appears. Our remedies are, vigilant searching for them and destroying them by hand.

THE POTATO BEETLE (*Doryphora decemlineata*).

No longer maintains the destructive character which it brought with it at the first, nor are our people so alarmed and troubled by its presence; it has become now a familiar matter-of-course arrangement. Although yet pretty numerous, it affects only the careless and the indolent; the industrious and the ingenious not only baffle their efforts, but to a very large extent render them harmless. It is now well ascertained by our potato raisers that the first broods are comparatively light, and that the insects best efforts are not made until mid-summer and after, so by planting largely or altogether early maturing varieties, and these placed in the ground as early as possible to get their tops and their tubers ripe before the second brood appears, all danger is out of the way. The beetle is perfectly baffled by this arrangement, and it goes wandering about over the fences and on the streets and roads seeking green fields where to pasture, and to deposit its myriads of eggs. This season the crop of potatoes, at least in this section, has been most abundant and of great excellence, the variety mostly *Early Rose*, the best potato that was ever given to the American people. Our remedies for the beetle were hand picking; and occasionally a dose of Paris Green applied as a liquid.

THE GRAPE VINE BEETLE *(Pelidnota Punctata,* see fig. 31.)

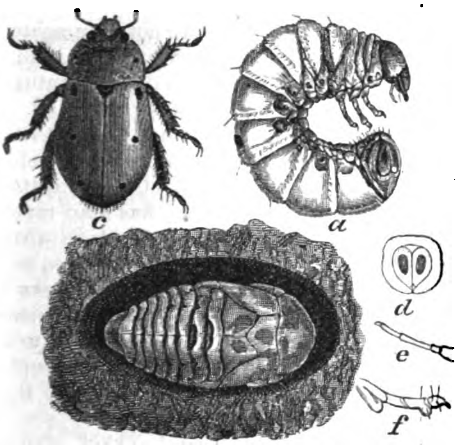


Fig. 31.

Seems very fond of harboring about our grape vines, and has this season been pretty plentiful, but we fail to observe that its presence is an alarming evil or that its injuries are very distinctly marked. It rather appears a sort of harmless case, a pretty creature, whose only office is to vary and beautify nature. But these remarks are not in the least applicable to **THE GRAPE VINE FLEA BEETLE**, Fig. 32 larva; Fig. 33 the perfect beetle *(Haltica Chalybea)*, whose numbers in the spring are rather alarming. This insidious, heartless little arch rogue attempts to baffle and frustrate our plans in the very start. This it does by boring into the swelling bud and totally destroying its promising contents, and thus by one effort he flattens our sanguine hopes by taking the entire product of the bud, leaf, cane, fruit and all. We this year hired our children to capture them on the vines as they were at work, which they readily, cheerfully and effectually did. In this way their efforts were greatly lessened. It is becoming more and more evident that we also in this country may yet have trouble from **THE GRAPE VINE PHYLLOXERA** *(Phylloxera Vastatrix)*. I have already seen specimens of it, and it is my most decided opinion that unless some effectual remedy is found, our grape vines will be found to suffer much from the injurious effects of this tiny insects, upon their leaves and especially their roots. Grape growers should seriously study this subject at once; for should the evil become established upon their vines, it would at length be very difficult to eradicate. For description and very full particulars, see Rev. Mr. Bethune's very able and instructive article on the subject in the Society's Report for the year 1874.

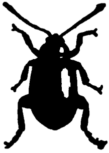


Fig. 33, the perfect beetle.

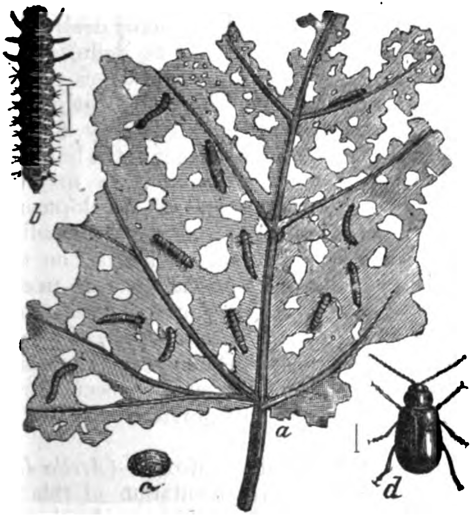


Fig. 32, larva.

PLANT LICE *(Aphididae, Fam. Eriosoma)*, particularly. Although aphidians in great numbers and different species feed very heavily upon the leaves of our Cherry, Pear, Apple and other trees, yet this white woolly aphis feeding in immense numbers on the stems and shoots of our young apple trees seem to be the most injurious, and should be looked after most vigilantly. They differ from most insects in one particular, viz.: they attach themselves to a certain spot or spots on the trees, and without locomotion attract their food to them! An opening is made in the bark of the tree which bleeds freely for their support. And the accumulation of unused or unsuited matter forms excresences about the place. It seems to me they pump very heavily on the vitality of the tree, especially in its young and tender years; and should be kept off by means of oil applications, or destroyed by the hand rubbing them from the spot and crushing them.

THE APPLE FRUIT MOTH.—(*Carpocapsa pomonella*).

commonly called codling moth. (See Fig. 34). As usual, has been very dilligent this season, and wherever there was fruit upon which to feed, it has shown that this fruit was not overlooked. An account of the general and almost unparalleled scarcity of the fruit, however, this season, it is confidently hoped that they have not propagated to any great extent, and that a comparative immunity from their ravages may be expected in the future. The apple-grower must ever be industrious, and at all times on the watch, never forgetting that "*eternal vigilance is the price of fruit.*" This advice also holds good in the case of plums, for THE PLUM CURCULIO (*Conotrachelus Nenuphar*, see Fig. 35), has had much better accommodation for rapid propagation than that of the apple moth. The plum crop in some sections was very abundant and good; but in others it was totally destroyed by the workings of this industrious and active beetle. I noticed also that the little Turk, as it has appropriately been called, would not scruple to attack our peaches, in case a scarcity of plums occurred, and that in this way the the peach crop this season suffered very severely.

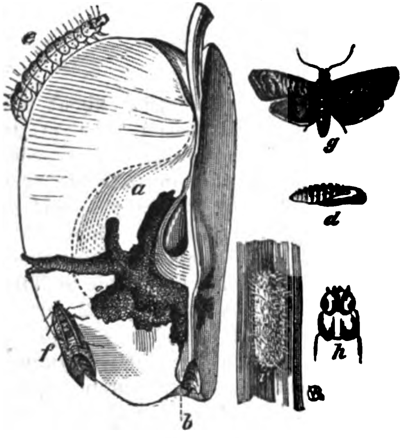


Fig. 34.

THE CABBAGE WORM (*Pieris rapae*), has this season been at work in full force, and has been very generally and extensively disastrous to our cabbages. They are very troublesome, especially to market gardeners, and where remedies were not used, the cabbages were totally destroyed. The parent of this larva seems to have no definite conception of the nature and severity of the changes of our climate, and in this respect it shows its foreign origin, as in any fine day in October she may be seen busily flitting about over the cabbages, &c., apparently eager in the business of depositing her eggs; and the young larva may be seen thus late in the season in all stages of development, regardless of the severe and destructive changes that are at hand. A sharp Canadian frost comes as it did this year, Nov. 9, and lays the whole brood motionless on the ground. Nevertheless there may be some danger of protecting these late worms in our ellars and cabbage pits, where the crop has been early stored away; and so the conditions for future broods may thus be secured. But perhaps there is little need of concern on this point, as insect nature has usually been found to carefully and effectually provide for itself.

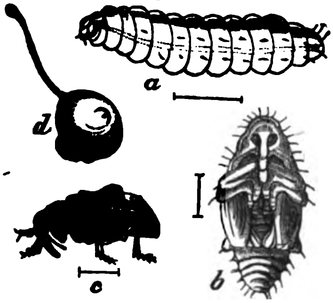


Fig. 35.

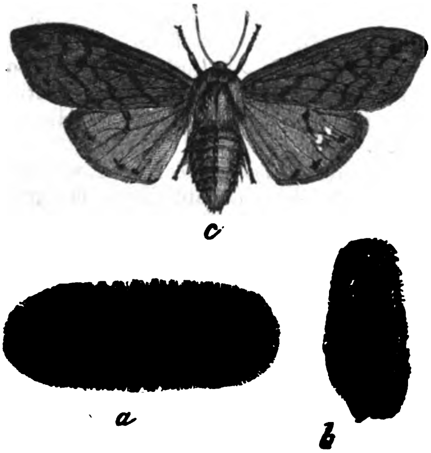


Fig. 36.

☞ THE ISABELLA TIGER MOTH.—(*Arctia Isabella*. See Fig. 36 for representation of this insect in its various stages).—As usual, has an abundance of her hairy larva abroad this fall. But as these hairy caterpillars are not known to be very seriously injurious to vegetation, and so scarcely come under our caption. I therefore pass them gently by. I have thus hastily glanced at some of the most common and prominently destructive insects that have come forcibly before my notice this season. I regret, however, my utter inability to treat the subject more thoroughly, and to better advantage.

The following details were got up for one of our weekly newspapers this summer, and entitled,

AN INSECT REGISTER FOR 1877.

May 10th.—Tent caterpillars first hatched out.
May 25th.—Gooseberry worms began actively to work into the young fruit.
May 30th.—Forest tent caterpillars began to leave the woods in great numbers.
June 1st.—The currant worms began to work on the leaves, but apparently were not so numerous as formerly.
June 18th.—Potato beetle larvae began to hatch out, but not so numerous as in former years.
June 20th.—Gooseberry worms leave the bushes, and retire into the ground to change. Also cut worms are not so numerous or destructive as in former years.
June 21st.—Tent caterpillars began to spin cocoons and retire to change.
June 25th.—The plum weevils very numerous, and have destroyed many of our plums and peaches. Also the apple fruit worm, or codling moth, larva not much to do this season—*no apples.*
" —Canker worms, measuring worms, and other larvae of various insects are very plentiful this season, and we are suffering much from their depredations.
June 27th.—Not many tent caterpillars now abroad.
June 28th.—First swarm of bees this season.
June 30th.—First newly-made tent caterplllar's cluster of eggs. Moths perfected.
" —The currant worm moth still propagating, and young hatching out.
July 2nd.—Pea beetle began to deposit eggs in young peas.
Oct. 12th.—The cabbage worm butterfly still depositing her eggs, and the young larva still hatching out.
Nov. 9th.—Hard frost, completely stopped the cabbage worm from further increase.
Nov. 12th.—Canker worm moths very thickly on the wing, their females clustering on the branches of the trees.
Nov. 29th.—Musquitoes, black flies, and most of the insect world silently nested away for this season.

Arkona Nurseries, November, 20th, 1877.

ON GRAPE VINE GALLS.

COMPILED BY JOSEPH WILLIAMS, LONDON, ONTARIO.

THE GRAPE-VINE APPLE GALL. (*Vitis pomum*) WALSH & RILEY, ORDER, *Diptera* FAMILY, *Cecidomyidæ*.

The following discriptions have been compiled from the valuable reports of Prof. C. V. Riley, St. Louis, Mo.

Besides the leaf-gall caused by the Grape Phylloxera, the Grape Vine is subject to various other gall-growths or excrescences, the nature of which often puzzles the vine grower. I shall give an account of four of the most conspicuous which are found in Missouri. They are all caused by Gall gnats (*Ceoidomyidæ*), the larvæ of which are distinguished by being of an orange-colour; but more especially by having on the upper surface, near the head, a horny process known as a breast-bone.* This process is variable in shape, but more often clove-shaped, Y-shaped, or oar-shaped. It always has a stem, which is mostly hidden, and terminates in two projections or prongs (sometimes three in those which are oar-shaped), which are armed with sharp points. It is retractile, and the prongs may be exerted at will, and are doubtless intended to assist in abrading the tissues of plants, so as to cause an abnormal flow of sap, which serves as food for the larvæ. That they have little, if anything, to do in causing the gall growth, we may infer from analogy, and from the fact that many Cecidomyidous galls are formed before the larvæ hatches, and depend on something deposited with the egg. The perfect flies are of a dull black colour, like that represented at figure 37, (*a* female, *b*, antennæ of male), and many species so closely resemble each other, that it is next to impossible to distinguish them when dry. Those which produce the galls here mentioned, are difficult to rear, and with one exception not yet known.

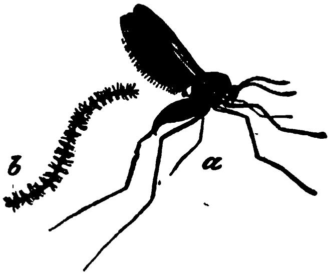


Fig. 37.

The Grape-Vine Apple-gall has been a fruitful source of speculation, and has given rise to some curious botanical theories, as the following extract will attest:

AN APPLE GROWING ON A GRAPE-VINE.

A Vegetable Phenomenon.—In the garden of Capt. David E. Moore, Lexington, Va., there is growing on a grape vine, a fully developed apple. On one side of the apple is an appearance of what might have been a grape-bloom. This interesting *lusus naturæ* is, as far as we know, without precedent, and of course has attracted marked attention, and caused no little speculation in the circle learned in such matters about Lexington. The prevailing opinion, we learn, is that an apple-bloom falling accidently upon a grape-bloom, became incorporated with it and produced the result; but, if so, is it not singular that such an accident has never occurred before? And, if so, again, does it not teach that the grape and apple may be grafted on each other? We hope the pomologists of Lexington will note very carefully all the phenomena of this freak of nature, and that they will have the apple photographed, with a portion of the vine, before its removal, for engraving and publication in Horticultural journals.—*Richmond Whig.*

---

* This process is said by all authors with whom I am acquainted, including Baron Osten Sacken, to be neutral, for which reason I suppose, it has been called the "breast-bone." I believe myself that it is dorsal. As, however, it sometimes has a good deal the form of the breast-bone, or "wish-bone" of a fowl, the term may be retained, though conveying a wrong idea. The larvæ are also said to differ from all other insect larvæ in having fourteen joints. I have examined a great number of Cecidomyidous larvæ without being able to make out any such abnormal number, while in many species it is difficult to detect more than twelve and a subjoint. Usually, I have been able to clearly make out thirteen joints and a subjoint, which is, the normal number in insects. (*Rules.*)

When growing on vines in the vicinity of hickory trees, it has ridiculously been considered a hybrid fruit between these two very widely separated plants.

The form of the gall is variable—sometimes being quite flattened or depressed, but more often spherical, or flattened at base and more pointed at tip. When young it is downy on the outside, and succulent, with a pleasant acidulous flavour. When mature, it usually has eight or nine longitudinal lobes, as in a musk-melon, and is smoother (Fig. 38 *a*). A transverse section (*b*) shows it to consist of a fleshy outside covering, like the hull of a walnut, and of a much harder, woody interior, with numerous longitudinal two-tiered cells or cavities, the upper tier twice as long and more regularly separated by harder fibre than the lower. The yellow larvæ are found in these cavities, and they have a brown clove-shaped breast bone. This gall which bears so great a semblance to a fruit, doubtless carries the semblance still further by falling to the ground. And, as the seed is released upon the death of the fruit which surrounded it, and consigned to the bosom of the great mother earth for development, so the larvæ escape from the decomposing and softening gall to consign themselves likewise to the same great nursery, which seems to be absolutely necessary for their well-being and growth, as I have kept the galls for over a year out of earth and away from her fecund influences without getting the perfect gnats.

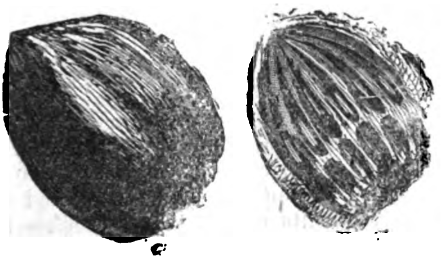


Fig. 38

This gall was first described in the *American Entomologist*, (vol. 1, p. 106.)

THE GRAPE-VINE FILBERT-GALL, (*Vitis coryloides*) W. & R.

(Order, *Diptera*; Family, *Cecidomyidae.*)

This gall (Fig. 39 *b*), as its name implies, bears some resemblance to a large bunch of filberts or hazel-nuts. It is found more frequently than the other, and especially on the River Bank grape (*Riparia*), in the month of July. It is an assemblage of separate galls, more or less coalescent, varying in number from ten to forty or more, and of different shapes, being either round, irregularly oval, fusiform or pyriform, but generally narrowing at the tip. When young, these galls are densely pubescent or woolly on the outside, but less so when mature. The interior is fleshy, juicy, sub-acid, and a tranverse section shews a single longitudinal cell in each (Fig. 39 *c*). The gall is evidently a deformation of a bud, as it springs from a single point where a bud would be, and often has quite a stem to it. A stunted deformed leaf is also sometimes found upon it, as given in the figure.

The larva is orange-yellow, partly transparent, partly opaque, and has the breast-bone clove-shaped, as in the preceding (Fig. 39 *a*), first described in *Am. Entomologist*, (I. p. 107).

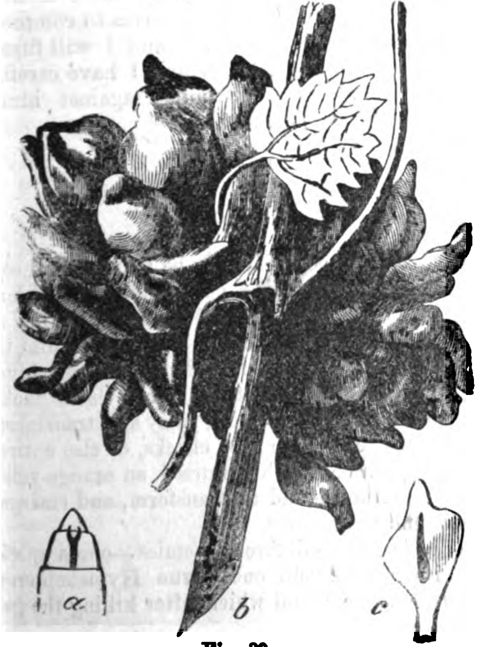


Fig 39.

The Grapevine Tomato-Gall, (*Vitis tomatos.*)

(*Made by Lasioptera vibis O. S.*)

(Order, *Diptera*, Family, *Cecidomyidae.*)

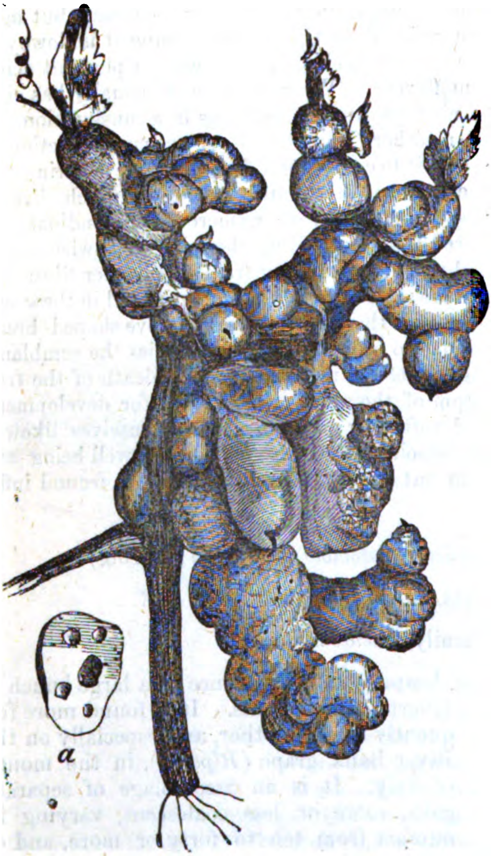


Fig. 40.

The following clipping will show that this gall, which is quite common on the River Bank grape and its cultivated varieties, has not remained unnoticed by the curious, and that it has, like the others, its fruit resemblances.

Freak in a Vineyard.—In gathering grapes to-day we found one of the clusters in shape a *perfect tomato.* It is of quite large size, and on the outside is divided into eight segments or lobes, having a seed to correspond with each segment or lobe. It was found on a cluster of one of Rogers' Hybrids, and a peculiarity is, that the grape is *blue*, while this is *red.* In flesh and seeds and all else it is a perfect grape. President Wilder's Trophy tomato stands about three rods from the vine. I call upon President Wilder to explain with what sort of propagating qualities he has invested his Trophy tomato, to know, if we continue the cultivation of that fruit, whether our apples, plums, cherries, etc., will or will not turn into Trophy tomatoes. I have saved the eight seeds for the further solution of the problem. If President Wilder declines an explanation for *fear of the consequences*, I call upon all the horticulturists of America to commence at once an investigation and I will furnish them with the *hide*, which I have carefully preserved as a testimony against him.—*Rural New Yorker.*

R. L. Dorr.

Dansville, Livigston County, N.Y. Oct. 6th, 1872.

It is the most variable gall with which I am acquainted, as it may be found of all sorts of fantastic shapes, from the single, round cranberry-like swelling on a tendril to the large collection of irregular bulbous swellings on the stem or leaf-stalk; sometimes looking not unlike a bunch of currants or a bunch of grapes, but more often like a bunch of diminutive tomatoes, such as the Cluster Tomato, grown by Mr. J. C. Ingham, of St. Joseph, Michigan. It was first briefly described together with the fly which produces it, by Baron Osten Sacken (Diptera of N. A., part I. pp. 201–2). The substance of the gall is soft, juicy and translucent, the flavour pleasantly acid, and the colour yellowish-green, with rosy cheeks, or else entirely red. Each swelling has several cells (Fig 40*a*) in each of which is nursed an orange-yellow larva, which, upon the dissolution of the gall, enters the ground to transform, and emerge a pale reddish gnat with a black head and antennæ and gray wings.

This gall-maker is subject to the attacks of at least two different enemies—one a species of *Thrips*, which invades the cell and destroys its inmate, and one a true Hymenopterous parasite, belonging apparently to the family *Proctotrupidæ*, and which after killing the gall-maker, spins a cocoon within the cell.

THE GRAPE LEAF TRUMPET-GALL—(*Vitis viticola O. S.*)—*Order Diptera. Family Cecidomyidæ.*

This is another, more regular gall, made by a gall-gnat which has not yet been described. is elongate, conical, and grows more or less numerously from the surface of the leaf, looking something like a small trumpet. (Fig. 41) I have found it on both wild *Cordifolia* and *Riparia*, and it doubtless occurs on their cultivated varieties. It is also found on *Labrusca* and *Vulpina*. (See A. E., II. p. 28.) The usual colour is a bright crimson, but it sometimes inclines to green; especially when young or on the under side of the leaf; for though it is more often found on the upper side, I have met with it antiposed. Upon cutting into these galls, we shall find them to be hollow, and each to contain a pale orange larva, which probably resembles those already mentioned in transforming under ground. The gall was at first briefly described by Baron Osten Sacken (Diptera of N. A., part I., p. 202). Similar but distinct galls grow on the leaves of Hickory and Hackberry, but are always green.

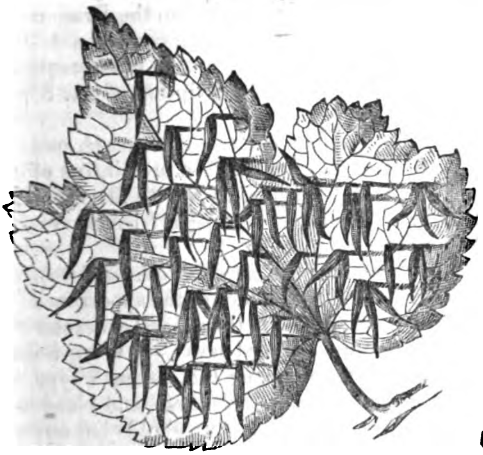


Fig. 41.

DRAGON FLIES.

By Joseph Williams, London, Ontario.

In the months of July and August there are few insects more abundant than the Dragon flies, and none which attract more attention from even the most indifferent observer, and a description of the more common kinds and some account of their habits may not be uninteresting. For the following account we are largely indebted to the graphic description of A. S. Packard, Jun., in our " Common Insects."

In various countries these insects have received various popular names—the French call them Demoiselles; the Germans, Florfliegen or Gauze-flies, or Wasserjungfern or Virgins of of the Water; while the English style the Dragon flies, Horse-stingers, or Devil's Darning-needles. The English terms, although less poetical than those of our European friends, are, we believe, more appropriate to the private character of these insects.

The accompanying illustration of one of our most common species (*Libellula trimaculata*), Fig. 42, will give an idea of the appearance of these insects. Of the general character of the group Packard says:—" Were we to select from among the insects a type of all that is savage, relentless, and bloodthirsty, the Dragon fly would be our choice. From the moment of its birth until its death, usually a twelvemonth, it riots in bloodshed and carnage. Living beneath the waters, perhaps eleven months of its life, in the larva and pupa states, it is literally a walking pitfall for luckless aquatic insects; but when transformed into a fly, ever on the wing in pursuit of its prey, it throws off all concealment, and reveals the more unblushingly its rapacious character.

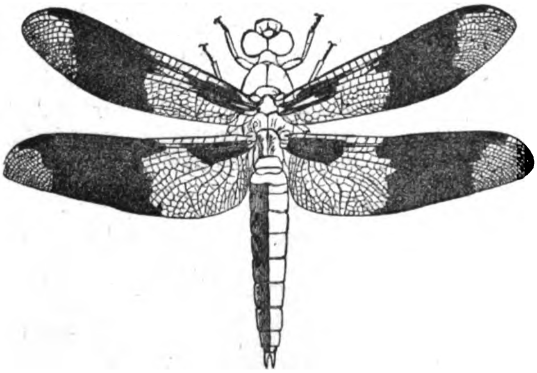


Fig. 42.

" Not only does its horrid visage and ferocious bearing frighten children, who call it the 'Devil's Darning-needle,' but it even distresses older persons, so that its name has become a by-word. Could we understand the language of insects, what tales of horror would be revealed! What traditions, sagas, fables, and myths must adorn the annals of animal life regarding this dragon among insects!

" To man, however, aside from its bad name and its repulsive aspect, which its gay trappings do not conceal, its whole life is beneficent. It is a scavenger, being like that class ugly and repulsive, and holding literally, among insects, the lowest rank in society. In the waters it preys upon young mosquitoes and the larva of other noxious insects. It thus aids in maintaining the balance of life, and cleanses the swamps of miasmata, thus purifying the air we breathe. During its existence of three or four weeks above the waters, its whole life is a continued good to man. It hawks over pools and fields and through gardens, decimating swarms of mosquitoes, flies, gnats, and other baneful insects. It is a true Malthus' delight, and following that sanguinary philosopher, we may believe that our Dragon fly is an entomological Tamerlane or Napoleon sent into the world by a kind Providence to prevent too close a jostling among the myriads of insect life.

" We will then conquer our repugnance to its ugly looks and savage mien, and contemplate the hideous monstrosity—as it is useless to deny that it combines the graces of the Hunchback of Notre Dame and Dickens' Quilp, with certain features of its own—for the good it does in Nature.

" Even among insects, a class replete with forms the very incarnation of ugliness and the perfection of all that is hideous in nature, our Dragon fly is most conspicuous. Look at its enormous head, with its beetling brows, retreating face, and heavy under-jaws—all eyes and teeth—and hung so loosely on its short weak neck, sunk beneath its enormous hunchback—for it is wofully round-shouldered—while its long, thin legs, shrunken as if from disease, are drawn up beneath its breast, and what a hobgoblin it is!

"Its gleaming wings are, however, beautiful objects. They form a broad expanse of delicate parchment-like membrane drawn over an intricate network of veins. Though the body is bulky, it is light, and easily sustained by the wings. The long-tail undoubtedly acts as a rudder to steady its flight."

While we do not hold the Dragon fly to be the "very incarnation of ugliness and the perfection of all that is hideous," as does the author above-named we do not believe its benefits to man have been exaggerated. The rapid flight and enormous range of vision of these creatures enable them to capture other insects with ease; while, their taste not being limited, they destroy moths, butterflies, and other insects without compunction, and they have been known to destroy and eat each other as well as very small fishes. However, it is this ravenous propensity which makes this insect so valuable to man, as they destroy immense numbers of other insects which are injurious to vegetable and other products, while they do not injure these substances themselves. A few of them shut in a house will soon rid it of flies, bugs, and mosquitoes, and therefore their presence should be welcomed. The popular opinion that they are dangerous to man is without foundation, as they can neither bite, sting or poison him.

We may now consider the development of *Libellula trimaculata*, previously figured, as it furnishes some curious and interesting information, and may be taken as representing that of the group.

When the female is about to deposit her eggs, she attaches herself to some plant growing out of the water, and pushing her abdomen beneath the surface, glues a bunch of eggs to the submerged stem or leaf (Uhler). These eggs produce larvæ which have a distant and ugly resemblance to the perfect insect. The larva is active and passes its existence in the water, feeding on numerous weaker insects. It possesses a curious syringe-like apparatus situated in the end of the body, by which it discharges a stream of water for a distance of two or three inches behind it, thereby propelling the insect forward. The motion thus given is most irregular and appears to be beyond the control of the larva. This curious arrangement serves for respiration as well as locomotion.

The larva soon reaches the pupa state (corresponding to the chrysalis state of a butterfly), in which it is also active, crawling over the bottom of the stream preying on other insects. In this state it is longer than the larva and still more resembles the perfect insect. When about to become a perfect insect, the pupa climbs up some suitable plant near the surface of the water, and attaching itself firmly awaits the last great change. In a short time the skin opens down the back and the adult Dragon fly, by bending backwards and forwards for some time, emerges. It only requires to remain a few hours, until its wings attain their full size and hardness, when it starts off on a life-long expedition of plunder.

In Fig. 43 we have a representation of three stages in the life of a foreign *Libellula*. The figure on the left shows the larva using its *mask* to capture prey; the figure on the right represents the perfect insect in the act of emerging from the pupa case.

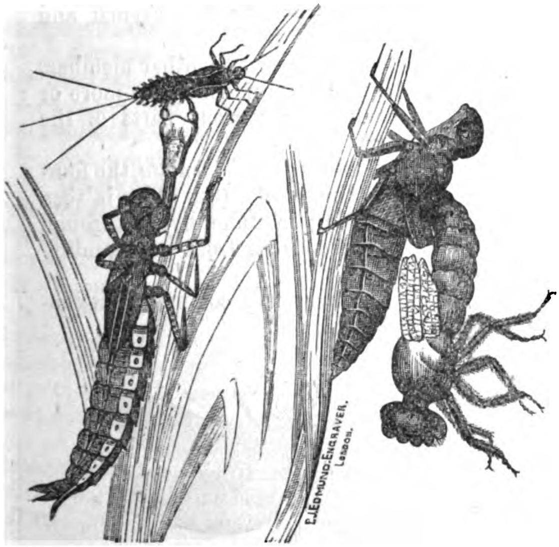

P.J.EDMUND. ENGRAVER, LONDON.

Fig. 43.

The full-grown *Libellula* may be described as follows:—The body is much elongated and cylindrical, and attains a length of two inches, in average specimens. The head is large and bears two very large and prominent compound eyes. These eyes which consist of many thousand facettes each, are so large that they meet on the upper surface of the head. This great power of vision is still increased by three simple eyes, or ocelli, situated on the upper surface of the head. From the front part of the head project two short tapering antennæ. The mouth occupies the front surface of the head, and is a most formidable structure. The upper lip is broad and conceals very powerful toothed organs, called mandibles; the other organs of the mouth are also armed with strong teeth which enable the creature to satisfy its carnivorous desires. The most remarkable portion of the mouth, however, is the lower lip, a large, flat, lobed organ, closing the mouth from the under side, and which may be projected forward to a comparatively great distance when attacking other insects.

The thorax, or middle portion of the body, is three or four times as long as the head, and very much greater in diameter. It resembles the head in colour, being of a medium chocolate shade, and is sparsely clothed with very short hairs of the same hue.

The abdomen, or posterior part of *L. trimaculata* tapers very gradually to the end, and is much smaller than the thorax in diameter, but more than twice its length. The colour is slightly paler, and is relieved by a line of yellowish blotches along each side, which gradually becomes smaller in size toward the end of the body. The upper surface is arched, while the under is flattened.

The legs are six in number, and are attached three to each side of the lower surface of the thorax.

The wings, which are four in number, are attached two to each side of the upper part of the thorax, and are about one and a quarter inches long, and three-eighths to nearly half an inch in breadth; the front ones being slightly the narrowest. The substance of the wings is a very delicate network covered by a thin transparent membrane, having a shining surface. From the place of attachment of each wing, there proceeds a narrow elongated patch of a deep brown colour, while from about the middle of the wings there is a large irregular patch of the same colour, which extends completely across. The structure of the wings combines great strength with lightness, thereby enabling the insect to fly with very great rapidity. Their shining surface, transparency and brilliant colouring in this and other members of the same order, combine to give them a beautiful appearance when flying in the bright sunshine, and evidently suggested the popular names given to them by the French and Germans.

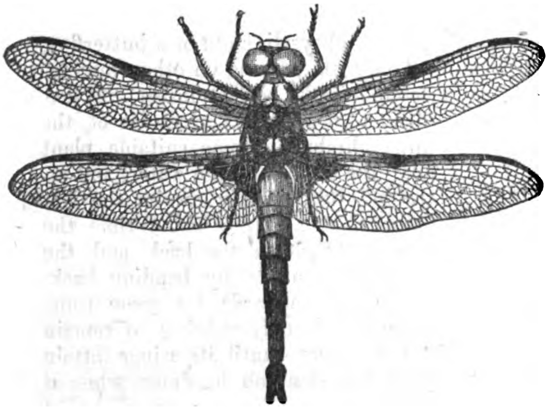


Fig. 44.

There are several other members of the same group which are more or less common in various parts of the country.

Libellula quadrimaculata, the four-spotted Dragon fly, (Fig. 44.) is seen on the wing in June, flying through dry pine woods far from any standing water.

Another very common Dragon-fly is the ruby Dragon-fly *Diplax rubicundula*, which is yellowish red.

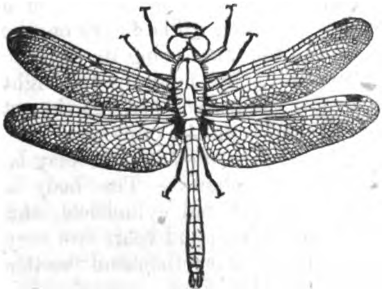


Fig. 45.

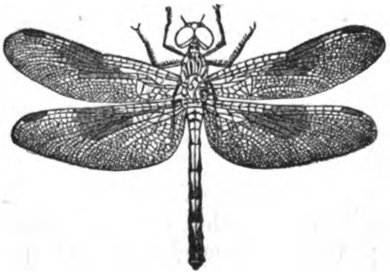


Fig. 46.

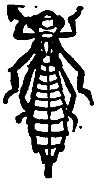


Fig. 47.

Another common form is *Diplax berenice*, (Fig. 45, male; Fig. 46, female). The accompanying cut (Fig. 47.) represents the larva, probably of this species, according to Mr. Uhler. It is black, the head blue in front, spotted with yellow, while the thorax and abdomen are striped with yellow. There are fewer stripes on the body of the male, which has only four large yellow spots on each side of the abdomen.

Still another specimen is *Diplax Elisa*. It is black, with the head yellowish and with greenish yellow spots on the sides of the thorax and base of the abdomen. There are three dusky spots on the front edge of each wing, and a large cloud at the base of the hind pair towards the hind angles of the wing.

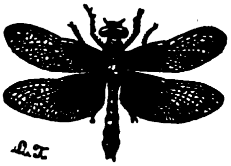


Fig. 48.

Rather a rare form, and of much smaller stature is the *Nannophya bella*, (Fig. 48.) It was first detected in Baltimore, and was afterwards found unfrequently by a pond in Maine. Its abdomen is unusually short, and the reticulations of the wings are large and simple. The female is black, while the male is frosted over with a whitish powder.

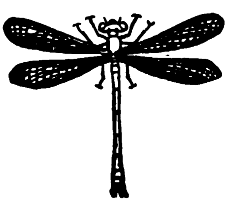


Fig. 49.

In the allied genus *Agrionina*, there are many interesting insects; we give an illustration in fig. 49. of one of the most common, *Agrion saucium*. This insect is smaller in size than those we have previously mentioned.

Although in this country we rarely see Dragon-flies gathered in large numbers at one time, yet it is known that in some countries they not unfrequently form immense swarms. In Kirby and Spence's Entomology we find the following:—" Meinecken tells us, that he once saw in a Village in Anhalt, on a clear day, about four in the afternoon, such a cloud of Dragon-flies (*Libellulina*) as almost concealed the sun, and not a little alarmed were the villagers, under the idea they were locusts; several instanees are given by Rosel, of similar clouds of these insects having been seen in Silesia and other districts; and Mr. Woolnough, of Hollesley in Suffolk, a most attentive observer of nature, once witnessed such an army of the smaller dragon-flies, (*Agrion*) flying inland from the sea, as to cast a slight shadow over a field of four acres, as they passed.

A migration of Dragon-flies was witnessed at Weimar, in Germany, in 1816, and one far more considerable, perhaps the greatest on record, May 30th and 31st, 1839, when cloud-like swarms of these insects, chiefly (*Libellula depressa*) were seen at Weimar, Eisenach, Leipsig, Halle and Gottingen, and the intervening country, extending over a large district."

Although so well known in the adult or perfect state, comparatively little is known of the transformations of Dragon-flies. They may be easily kept in aquaria where their various changes may be watched, and any one who can spend the necessary time and patience in rearing them, so as to trace up the different stages from the larva to the adult fly, and describe and figure them accurately, will do good service to science (Packard).

The graceful appearance of these insects has not escaped the notice of poets, for Moore alludes to them as " the beautiful blue damsel flies," while Tennyson, in his poem of the " Two Voices," gives the following description:—

To-day I saw the Dragon-fly
Come from the wells where he did lie.
An inner impulse rent the veil
Of his old husk: from head to tail
Came out clear plates of sapphire mail.

He dried his wings: like gauze they grew;
Through crofts and pastures wet with dew
A living flash of light he flew.

THE HESSIAN FLY.

(*Cecidomyia destructor Say.—Diptera : Tipulidæ.*

BY THE REV. C. J. S. BETHUNE, M.A.

For many years this Province has happily been almost entirely free from the ravages of the Hessian Fly. During the present year (1877) however, this very destructive insect has again appeared in the wheat-fields, and is attracting much attention from farmers and others specially interested in the culture of this most important cereal. As far as we have been able to obtain information the Hessian fly has been recently observed in the counties of Grey, Simcoe, York and Ontario, and also in the County of Oxford. No doubt, if not checked, it will soon spread over a much wider area, and cause much loss and disappointment to our wheat-growers.

The subject being one of so great importance, it has been considered advisable to reproduce here our Report upon this insect, published six years ago (*Report of the Entomological Society of Ontario*, 1871, pages 392-5).

The Hessian fly, together with a number of other most destructive insects, has come to us from the other side of the Atlantic. European entomologists have repeatedly maintained that it must be a native of America, as no such insect was observed amongst their wheat-fields during a long series of years; and Mr. Curtis has even gone so far as to call it "the *American* wheat-midge," in contradistinction to what he terms "the *British* wheat-midge" (*C. tritici*). It is now, however, generally admitted that it is of European origin, and it is almost certain that it was first brought to this continent in some straw used for the purpose of packing by the Hessian troops, under Sir William Howe, during the American War of Independence. These soldiers landed on Staten Island, and on the west end of Long Island, in the year 1776, and in this neighbourhood the fly was first observed; hence it obtained its popular name of "Hessian Fly." Having multiplied in these places—as Dr. Harris relates—"the insects gradually spread over the southern part of New York and Connecticut, and continued to proceed inland at the rate of fifteen or twenty miles a year. They reached Saratoga (two hundred miles from their original station) in 1789." Proceeding in this manner, the tiny pest gradually spread over the country, and has been found in almost every locality where wheat is grown. In the old world also, its depredations have been sufficiently great to attract notice in England, France, Germany, Austria, Switzerland, Italy, Russia,—in fact in almost every country where this grain is cultivated to any extent. Our own Dominion, though frightfully devastated in subsequent years, was not invaded by the pest till about the year 1816, when it became prevalent in Lower Canada. It appears to have been first noticed in this Province in the year 1846. (For a detailed history of its progress in this country and the neighbouring States down to the year 1854, see Prof. Hind's Essay, pp. 42–46.)

So much has been said and written respecting the Hessian fly, and so many descriptions of it have appeared in agricultural and scientific publications, that we feel disinclined to attempt any new account of it or repeat once more "an oft told tale." As we have no new light to throw upon the subject, and, with the exception of some specimens received from Ancaster during the past summer, have had no opportunity for some years of investigating its habits, we shall not hesitate to make free use of the writings of others, especially those which are not likely to be accessible to the majority of our readers. In every case we shall, of course, make due acknowledgement of the source from which information is derived.

The Hessian fly, though known for its destructive qualities for some time before, was first scientifically described by Mr. Say—one of the most eminent of the early American

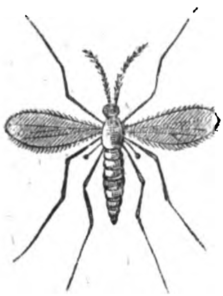
Entomologists—under the name of the Destructive Midge (*Cecidomyia destructor*). "This insect—Dr. Fitch relates—as a general rule passes through two generations annually. The first of these occupy the autumn, winter and fore part of spring, and is reared at the roots of the young grain slightly under the ground. The second occupies the remainder of the spring and summer, and is nurtured in the lower joints of the straw. The time when its several changes occur, however, is not perfectly uniform, being varied by the climate, the state of the weather and perhaps other contingencies, and it is not improbable that individual specimens, placed in circumstances unfavourable to their developement, in some instances have their growth so much retarded as to require even a whole year to complete their metamorphoses. In the ordinary course of nature, therefore, our crops of winter wheat are liable to two attacks of the Hessian fly, one generation reared at its roots produeing another which occupies the lower joints of the stalks. Thus the larvæ and pupæ are present in it almost continually, from the time the tender young blades appear above the ground in autumn till the grain ripens and is harvested the next summer. Our spring wheat, on the other hand, can rear but one brood of these insects; they consequently resort to it but little if at all. Nor can the Hessian fly sustain itself except in districts where winter wheat is cultivated, in which to nestle during the autumn and winter."

The eggs of the autumn generation are deposited by the female fly generally early in September, in the young fall wheat, in a crease of the leaf. Twenty or thirty eggs are laid on a single leaf, and these hatch out in about four days if the weather be warm. Mr. Tilghman, of Maryland, has published in *The Cultivator*, of May, 1841, the following minute and interesting account of the mode in which the eggs are laid: "By the second week of October, the first sown wheat being well up, and having generally put forth its second and third blades, I resorted to my field on a fine warm forenoon to endeavour to satisfy myself by ocular demonstration whether the fly did deposit the egg on the blades of the growing plant. Selecting a favourable spot to make my observation, I placed myself in a reclining position in a furrow, and had been on the watch, but a minute or two before I discovered a number of small, black flies alighting and sitting on the wheat plants around me, and presently one settled on the ridged surface of a blade of a plant, completely within my reach and distinct observation. She immediately began depositing her eggs in the longitudinal cavity between the little ridges of the blade. I could distinctly see the eggs ejected from a kind of tube or sting. After she had deposited eight or ten eggs, I easily caught her upon the blade and wrapped her up in a piece of paper. After that I continued my observations on the flies, caught several similarly occupied, and could see the eggs uniformly placed in the longitudinal cavities of the blades of the wheat, their appearance being that of minute reddish specks." These eggs are computed to be about one-fiftieth part of an inch in length.

When hatched from the egg, the next proceedings of the insect are thus related by Mr. Herrick:—"The little wrinkled maggot or larva creeps out of its delicate membraneous egg skin, crawls down the leaf, enters the sheath, and proceeds along the stalk, usually as far as the next joint below. Here it fastens lengthwise, and head downwards, to the tender stalk, and lives upon the sap. It does not gnaw the stalk, nor does it enter the central cavity thereof; but as the larva increases in size, it gradually becomes embedded in the substance of the stalk. After taking its station the larva moves no more, gradually loses its reddish colour and wrinkled appearance, becomes plump and torpid, is at first semi-transluoent, and then more and more clouded, with internal white spots; and when near maturity the middle of the intestinal part is of a greenish colour. In five or six weeks (varying with the season) the larva begins to turn brown, and soon becomes of a bright chestnut colour, bearing some resemblance to a flax-seed." Two or three larvæ, thus embedded in a stalk, serves to weaken the plant and causes it to fall down, or to wither and die.

In this condition, the "flax-seed state," as it is usually termed, the insect remains all winter. Regarding the structure and formation of this peculiar appearance there has been much controversy, into which we need not enter here. Suffice it to say, that some have held the opinion that the larva spins its cocoon which bears this form; others, that it is the hardened outer integument of the worm, separated from the insect, which remains within; others again, and notably, the late Mr. Walsh, that the pupal cocoon is exuded from the larva. Whatever may be the process, in this condition it remains till the warm days of spring arrive, when the insect completes its pupal state, and finally comes forth as a tiny two-winged fly. (Fig. 50.)

Fig. 50.



"The head, antennæ, and thorax of this fly are black; the hind body is tawny, more or less widely marked with black on each wing, and clothed with fine greyish hairs. The egg-tube of the female is rose-coloured; the wings are blackish, except at the base, where they are tawny, and very narrow,—they are fringed with short hairs and are rounded at the tip; the legs are pale red or brownish, and the feet are black. The body measures about one-tenth of an inch in length, and the wings expand one-quarter of an inch or more. After death the hind body contracts and becomes almost entirely black." (Harris, *Injurious Insects*, p. 570.) The antennæ of the female are about half the length of the body; those of the male three-fourths. The former are composed of sixteen oval joints twice as long as thick, and clothed with a number of hairs; the latter have short, round joints, each with a chord of rather long hairs.

After these flies come forth from the pupa state in the spring they speedily, set to work to lay their eggs on the leaves of the spring wheat, now appearing above the surface of the ground, as well as upon that sown the autumn before. From this batch of eggs another brood is soon hatched, the work of destruction goes on, and late in summer the second generation of flies comes forth. The larvæ of the summer brood are found almost always under the sheath of the leaf just above the first joint; their suction of the juices at that point weakens the stalk so much that a high wind very soon bends it down, and even breaks it off when the straw approaches ripeness. Of course the size and value of the grain is also immensely lessened by the absorption of the sap, which ought to go to filling out the ear. The winter brood attack the young plant lower down, and injure it at the root, frequently killing it outright.

Having now traced the life of the insect from the laying of the eggs in one autumn to the same point in the following year, we may turn our consideration to the remedies for the foe, which, as in the case of the wheat midge above, may be classified as natural and artificial.

Natural Remedies.—Though we are, unhappily, so very deficient in natural checks to the spread of the wheat-midge on this side of the Atlantic, our case is very different as regards the Hessian fly. It is preyed upon and devoured by a number of parasitic insects, whose combined attacks are computed to destroy nine-tenths of every generation of this pernicious foe. Mr. Say described one of the most useful of these parasites under the name of *Ceraphron destructor*. It is a shining black four-winged fly, about one-tenth of an inch in length. "In the month of June, when the maggot of the Hessian fly has taken the form of a flax-seed, the *Ceraphron* pierces it through the sheath of the leaf, and lays an egg in the minute hole thus made. From this egg is hatched a little maggot, which devours the pupa of the Hessian fly, and then changes to a chrysalis within the shell of the latter, through which it finally eats its way, after being transformed to a fly. This last change takes place both in the autumn and in the following spring. Two more parasites, discovered by Mr. Herrick, also destroy the Hessian fly, while it is in the flax-seed or pupa state." (Harris.) A fourth has been found by the same observer to attack the eggs of the enemy. "This egg parasite is a species of *Platygaster*. It is very abundant in the autumn, when it lays its own eggs, four or five together in a single egg of the Hessian fly. This, it appears, does not prevent the latter from hatching, but the maggot of the Hessian fly is unable to go through its transformations and dies after taking the flax seed form. Meanwhile its intestine foes are hatched, come to their growth, spin themselves little brownish cocoons within the skin of their victims, and in due time are changed to winged insects, and eat their way out."—Harris.

It is owing almost entirely to these minute allies that our crops have been preserved to so great an extent, of late years, from the ravages of the Hessian fly. For a time the pest inflicted great damage, but its enemies soon increased and gathered strength, and have succeeded in keeping it within due bounds. Assuredly, we should feel deeply grateful to the merciful Creator, who has provided such effectual, though apparently insignificant, means to save the fruits of our fields from destruction.

Artificial Remedies.—These are often attempted, but seldom with entirely satisfactory results. The best precaution to take—where the insect has shown itself in numbers and where the wheat-midge is not apprehended—is to sow the next crop of fall wheat as late as can be done with safety in the autumn—about the middle or towards the end of September.

This course prevents the parent fly from obtaining any young wheat upon which to lay their eggs, and destroys the prospects of another generation. A fertile, thoroughly-cultivated, and well drained soil is as effectual a means of escaping loss from the attack of this insect as any, probably, that can be mentioned. Benefit may also be derived from the sowing only of an approved flinty-stemmed variety of wheat, which is thus more capable of resisting the fly's attacks upon it. But after all the chief reliance for immunity is to be placed upon the labours of the parasitic insects mentioned above.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

Dr. Hagen.

ONTARIO,

FOR THE YEAR

1878.

Printed by Order of the Legislative Assembly.

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1879.

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REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE YEAR 1878.

To the Honourable the Commissioner of Agriculture:

SIR,—In compliance with the provisions of our Statute of Incorporation, I have the honour to submit to your consideration the Annual Report of the Entomological Society of Ontario, for the year 1878. Contained in which you will find a financial statement of the Society's condition, a list of the officials for 1879, as well as many papers, which I trust will be interesting and valuable.

The Annual Meeting of the Society was held in London on the 20th September, when reports from the Montreal and London branches were read, which showed these branches to be in a healthy and vigorous condition.

We are glad to note that the subject of Entomology is claiming more attention than heretofore, especially among our agriculturists; which points to a pleasing future, when this attractive study will be generally pursued throughout our land.

The organ of the Society, *The Entomologist*, is issued monthly, and regularly appears, its pages filled with the results of new and interesting observations on insect life. The number of its subscribers is yearly growing larger, and everything in connection with the Society indicates a prosperous condition.

The Report which we now present will be found to contain many excellent illustrations in connection with the subjects treated of, many of which have been specially engraved in England for this report.

I have the honour to remain, Sir,
Your obedient servant,
JOSEPH WILLIAMS.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The eighth Annual Meeting of the Entomological Society of Ontario was held in London, at the residence of Mr. Wm. Saunders, on the evening of the 20th September, 1878. The President, Wm. Saunders in the chair.

Letters of apology for non-attendance were read from the following members of the Council: Jas. Fletcher, Ottawa; J. G. Bowles, Montreal; and J. Pettit, Grimsby.

The President reported, that in consequence of removal to Montreal a few days previous to the meeting, Mr. J. Williams had been obliged to resign the office of Secretary-Treasurer.

The report of the Montreal Branch was next read, showing that organization to be in a prosperous condition, and the members active in the work of promoting Entomology in Canada. Similar remarks may be made in reference to the London Branch which is also in a flourishing state.

On behalf of the Council of the Parent Society, Mr. Saunders reported that a number of valuable works had during the year been added to the library.

The report of the Treasurer showed that the finances were in a satisfactory condition, there being a balance at the close of the financial year to the credit of the Society of one hundred and ninety-one dollars.

ANNUAL STATEMENT OF THE SECRETARY-TREASURER, ENTOMOLOGICAL SOCIETY OF ONTARIO, SEPT., 1878.

Receipts.

To Balance from 1877	$236 85
" Members' fees, sales of Entomologist	186 41
" Mdse, pins, lists, cork	57 49
" Advertisements	3 20
" Prizes	10 00
" Interest	6 24
" Government Grant	750 00
	$1,250 19

Disbursements.

By Postage	$ 16	93
" Petty expenses, freight, delegate to St. Louis, etc	61	67
" Salaries	150	00
" Engraving	107	95
" Printing Entomologist	383	39
" Mailing "	36	40
" Paper for "	67	20
" Insurance	10	63
" Rent for 1877 and 1878	160	00
" Library	15	44
" Expenses, Annual Report	49	50
Balance in hand	191	08
	$1,250	19

J. Williams
Secy.-Treas.

We certify the above to be correct.

Sept. 14th, 1878.

Chas. Chapman,
Ab. Puddicombe, } *Auditors.*

REPORT OF THE COUNCIL, 1878.

It is with great pleasure that we submit our Report, at this the close of the eighth year of our existence, because it speaks only of progress in the study in which we are so much interested and of prosperity in all the undertakings of the Society. It is pleasing to us to see the number of working Entomologists increasing, and to observe the advancement of the science through their efforts.

We think it especially gratifying, that our journal *The Canadian Entomologist* has not only continued to hold its own, but that it has increased in interest and usefulness, and is being more generally recognized by the public as a medium for the dissemination of important facts on all points connected with the study of insect life, especially of those which influence our agricultural productions.

As the future of our country is so bound up in our agricultural interests, it cannot be too strongly urged that there is a great necessity for energetic Entomologists to aid in carrying on the work which has so efficiently been done by the Society.

Our contributing staff has increased, and we take this opportunity of thanking those who have so ably helped to sustain our journal up to the present time, and request that they continue to enrich its pages with the results of their future investigations.

We feel our influence extending as we daily see our subscription list enlarging. Our journal is also being recognized by eminent Entomologists as a valuable means for the diffusion of scientific knowledge and is among the first to report any advancement in our special department, and always abounds in original research.

At the Annual Meeting of the "Entomological Club" of the "American Association for the Advancement of Science," held recently at St. Louis, our Society was represented by Mr. E. B. Reed, one of the editing staff of the *Entomologist;* many fresh and interesting facts were elicited which will have their due influence on entomology.

The branches of the Society in London and Montreal have been working constantly and much good has resulted from their labours. Frequent meetings have been held during the year, and many interesting evenings spent in discussions on entomological work; numerous papers have been read, some of which have been published in the *Entomologist*. These branches have displayed great activity as will be seen from their reports.

Submitted on behalf of the Council by

Joseph Williams,
Sec.-Treas.

The President then read his Annual Address.

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

To the Members of the Entomological Society of Ontario:—

GENTLEMEN,—Each revolving year brings its duties. To-day it is my privilege and a very pleasing duty to offer again to you a few words of encouragement, to refer briefly to some of the Entomological achievements of the past, and do what I can towards stimulating to further effort. The importance of the study of Entomology is yearly impressing itself more and more upon the public mind, as insect foes hitherto scarce become abundant, or as new ones invade our domain.

At present we are in danger from the approach of a new insect enemy which promises to give us a great deal of trouble. I refer to the new Carpet Bug, *Anthrenus scrophulariæ.* It was during the summer of 1874 that attention was first called by some of the newspapers in the Eastern States to the great damage being done to carpets in some of their cities on the sea-board by the ravages of an insect quite different from the well known Carpet Moth, *Tinea tapetzella*, and far more destructive; one which would attack new carpets as readily as old ones, and devour their substance with such rapidity and persistence as to raise a doubt in some minds as to whether, in case this insect becomes generally prevalent, the use of carpets could be continued at all. Two years later this pest was found common in Schenectady, N. Y., when they were shortly brought under the notice of one of our most active and thorough workers in the Entomological field, Prof. J. A. Lintner, of Albany, N. Y., who at once proceeded to investigate the life history of the insect. Up to this time little or nothing was known here in reference to it, other than that the destructive creature was a larva of some sort, nearly oval in form and about three-sixteenths of an inch long, with the body clothed with short hairs which were longer at each extremity. A number of these larvæ were collected and fed upon pieces of carpet, and their transformations carefully watched until the disclosure of the perfect insect, when it proved to be a member of that very destructive family of beetles known to Entomologists as the Dermestidæ. This insect, which proves to be a European species, has probably been imported from Europe with carpets brought to New York and Boston, at which ports its destructive efforts first attracted attention. The beetle, the parent of all this mischief, is a very small one, being not more than one-eighth of an inch long, and one-twelfth of an inch broad; it is nearly oval, black, with faint red and white markings. It does not confine its attention to carpets, but will eat any sort of woollen goods, but does not appear to injure those of cotton. In Europe it is said to destroy furs, clothes, collections of animals, insects and plants, and is sometimes very injurious to leather. A more detailed description of this insect and its workings, as furnished by Prof. Lintner's observations in his recent "Entomological Contributions," will be given in the annual report of our Society. As this insect has for some time past been committing great ravages in Buffalo, New York, it is not likely that we shall be long free from it; indeed it is altogether probable that it is already in our midst, although I am not aware that it has yet been brought under the notice of any of our Entomologists. Unfortunately it is a very difficult pest to destroy. The ordinary applications, such as camphor, pepper, tobacco, turpentine and carbolic acid, have, it is asserted, been tried without success, and no effectual means for its destruction has yet been devised.

Strange that so many of our most injurious insects have been brought from Europe, and that when introduced here they multiply to a far greater extent than in their native home. This rapid increase doubtless arises from the fact that they have numerous parasites in the place of their nativity which prey on them, and that these parasites are rarely imported with them, and hence it becomes a question of great practical importance as to whether these parasites might not by special effort be introduced, and thus materially lessen the losses which these scourges inflict on the community. We are indebted to Europe for the Codling Moth of the apple, *Carpocapsa pomonella;* the Currant Worm, *Nematus ventricosus;* the Oyster-shell Bark Louse, *Aspidiotus conchiformis;* the Cabbage Butterfly, *Pieris rapæ;* the Currant Borer, *Ægeria tipuliformis;* the Hessian Fly, *Cecidomyia destructor;* the Wheat Midge, *Diplosis tritici;* the Grain Weevil, *Sitophilus granarius;* the Cheese Maggot, *Piopila casei;* the Cockroach, *Blatta orientalis;* the Meal Worm, *Tenebrio molitor;* the Bee Moth, *Galleria cereana;* the Carpet Moth, *Tinea tapetzella;* the Clothes Moth, *Tinea vestianella;* the Bacon Beetle, *Dermestes lardarius*, and several others of lesser note.

It cannot be denied that there has been some reciprocity in the matter. We have given Europe the noted *Phylloxera vastatrix*, which has inflicted damage to the extent of millions of dollars on the vineyards there; they have also received now from us the much-dreaded Colorado Potato Beetle.

During the past season we have had a fair share of destructive insects. The Forest Tent Caterpillar, *Clisiocampa sylvatica*, has again been numerous in the district about London and in many parts west of it, but not so abundant as last year. The severe frosts in May destroyed myriads of the very young larvæ then newly hatched, and later in the season there prevailed among the nearly full-grown larvæ in some localities a strange disease which carried them off by hundreds. I myself saw large numbers of them still retaining their hold on fences and tree trunks, which, when touched, were found quite dead, and so decayed as to burst with a very gentle handling. Very many have also been destroyed in the larval state by parasites; probably one-half or more will perish from this cause alone. Birds also have devoured many of them. On one occasion the crop of a black-billed cuckoo, *Coccygus erythropthalmus*, was brought to me packed entirely full of these larvæ. Even their clusters of eggs, which they deposit in rings upon the twigs of trees, are not free from attack. Last winter I discovered a species of mite preying upon the eggs and devouring them rapidly; many clusters were found entirely destroyed in this way, others partially so, and as each cluster would contain probably two or three hundred eggs, some idea may be formed of the benefits conferred upon us by these tiny mites.

The Colorado Potato Beetle is still spreading eastward through the Maritime Provinces, and has this year reached St. Johns, New Brunswick, but it is no longer the fearful evil at first anticipated, and our farmers battle with it confidently, knowing that with a little perseverance in the use of Paris green, they can ride victorious over this formidable foe. The use of this poisonous substance has provoked much discussion, and unnecessary alarm has been excited by some writers, who have expressed grave fears that the use of so much Paris green would eventually poison the soil to such an extent as to render it permanently unfit for the growth of other crops. Several years ago Prof. W. K. Kedzie, of the Michigan Agricultural College, when experimenting in this direction, demonstrated that water charged with carbonic acid or ammonia dissolved a certain portion of the Paris green, but that this was quickly converted into an insoluble and harmless compound by combination with the iron which exists in almost every soil. As rain water always contains more or less of these ingredients, it is more than probable that the small portion of this poison used on potato fields soon loses its poisonous properties in this manner. In any case, one pound of the green spread uniformly over an acre of soil would only amount to less than one-sixth of a grain to the square foot, so that were the poison to remain unchanged, this minute portion might be added to the soil annually for a century without producing any perceptible deleterious effects on plant growth. It is to be regretted that any one should attempt to excite needless alarm in this way. Caution should be urged in handling this powerful poison, and it is often the case that more is used than is needed; these points are important and cannot be too often referred to. Paris green is best and most economically used with water in the proportion of one teaspoonful of the powder to a pailful of water, kept well agitated and sprinkled on the potato plants by means of a hand whisk dipped from time to time into the liquid. If the Paris green is pure this proportion is ample, but too often this useful compound is largely adulterated, a practice which some dealers are tempted to adopt from the eagerness with which a large portion of the public run after cheap goods. Paris green is frequently adulterated to the extent of from twenty-five to fifty per cent, chiefly with sulphate of baryta, a cheap and harmless mineral compound. By resorting to practices of this sort dishonest dealers can supply their customers at a less price than the cost of the pure article, and at the same time make large profits. It is a matter of regret that with an Adulteration Act in force, which if properly carried out would at once put an end to these and all such impositions, the public are not better protected.

The insect enemies of the Potato Beetle are in some localities rapidly increasing in numbers. In the annual report of our Society for the year 1871, our esteemed coadjutor, Mr. E. B. Reed, contributed an excellent article on the Potato Beetle, in which he enumerates a number of insects which prey upon this pest in the various stages of its growth, and among them refers to a species of *Lebia*, one of the active members of that family of beetles known as Carabidæ, all of whom devour other insects. This species, *Lebia grandis*, is there said to be rare in Ontario. The first examples of this insect which I remember capturing were taken last year at sugar when trapping moths, and I believe it is the only species belonging to that family which I have ever taken in this manner; several of them were found feeding on the sweet liquid on dark nights about 10 o'clock. Early this fall I received a letter from Mr. W. E. Coldwell, of Constance, Ont., announcing the appearance in large numbers of a friendly insect, which was devouring the larvæ of the Potato Beetle, and proving a very effectual check on their increase. This letter was accompanied by specimens of the insect, which, to my gratification, I found on examination were examples of *Lebia grandis*. A few weeks later a farmer in this neighborhood called on me with the information that he had observed large numbers of an insect which he had not seen before, devouring the larvæ of the Potato Beetle. He brought no specimens with him, but from his description of the insect I have every reason to believe that it was the same *Lebia*. Since then I have occasionally met with examples of this friendly visitor hidden amongst the leaves of plants, a common place of resort for it during periods of inactivity.

The Hessian Fly, *Cecidomyia destructor*, which appeared in force in many counties of our Province last year, and which it was feared might again become a serious trouble, has happily almost disappeared. I have not heard of any serious loss from this pest during the past season. Should any of you desire, at any time, information in reference to the life history and habits of this insect, I would refer you to a very practical paper in our last annual report, by the Rev. C. J. S. Bethune; also to a more elaborate paper by the same distinguished Entomologist in our report for 1871.

The Cabbage Butterfly, *Pieris rapæ*, still continues its ravages, but does not seem to be quite so abundant this year as it was last. Water heated to near the boiling point has been used with success in destroying the larva, without injuring the cabbage. Strong decoctions of Cayenne pepper and Smartweed (*Polygonum*——?) have also been spoken highly of; but I look forward with far more confidence to a remedy provided by nature which is gradually making itself felt. I allude to that tiny little friendly parasitic fly, *Pteromalus puparum*. which is rapidly increasing in our midst. A few days since, while watching some of the full-grown larvæ of the Cabbage Butterfly which were feeding on Nasturtium leaves, I was much gratified in witnessing the method of attack which this parasite adopts. Settling herself quietly down on the back of the caterpillar, near the terminal segments, with her head towards the caterpillar's head, she paused awhile; then with a sudden movement of her ovipositor, so quickly that the motion almost escaped detection, she thrust an egg under the skin of her victim. The caterpillar seemed startled, and quivering, jerked its head and anterior segments suddenly about, and then quieted again; the little tormentor meanwhile sitting perfectly composed on the spot where she first settled. Presently another thrust was made, followed by further uneasy movements of the larva, and in this manner, in the course of a very few minutes, quite a number of eggs were deposited. The caterpillar did not seem to be conscious of the cause of its troubles, nor, indeed, of the presence of its enemy, excepting when the thrusts with the ovipositor were made. On drawing a little nearer for the purpose of better observing this interesting operation, the tiny creature took alarm and flew off. Further examination revealed the presence of several more of these little friends, busily searching for further specimens to operate on. The eggs deposited soon hatch into little grubs, which eventually devour the body of their victim, and after it has entered the chrysalis state, eat small holes through the chrysalis, and thus make their escape. It has long been an unsettled point among Entomologists as to whether this parasite operates on her victim in the larval or chrysalis state, the weight of opinion being hitherto in favour of the view that the chrysalis is pierced and the eggs deposited in it; but from the observations here detailed it would appear that the eggs are usually, if not invariably, placed in the nearly full-grown larva.

At the same time I observed an insect belonging to the true bug family, Hemiptera, with its proboscis thrust into one of the same caterpillars, quietly sucking out its contents, the half-emptied victim vainly endeavouring to escape. As this bug was immature, I was unable to determine the species to which it belonged; it is pleasing, however, to know that there are several friendly helpers among the insect tribes aiding man in his efforts to subdue this obnoxious insect.

The Codling Moth of the apple is less abundant than usual this year, a scarcity which may be attributed to the early hatching of the moths during the very warm days of spring, and many of them perishing before the blossoms of the apple were sufficiently far advanced for them to operate on. Attention has been called again to the curious fact already noted in Europe many years ago, that the larva of this insect is sometimes occupied by a strange parasite, a species of *Mermis*, known commonly as a hair-snake, a name probably due to the absurd belief, not yet quite extinct, that horse-hairs placed in water eventually become endued with life, and change to hair-snakes. Several instances have occurred of late in the United States of these remarkable creatures being found in the interior of apples, where they had lived as parasites on the Codling worm, and having destroyed their host, remained in the fruit about the middle, where they were in danger of being eaten.

The Plum Curculio is no longer a stranger in that once famed plum-producing district of which Goderich is the centre. So plentiful has it become there now that some plum-growers are becoming quite discouraged and ready to give up the culture of the fruit entirely. This troublesome insect has not yet been reported from the Owen Sound district, where plum-culture is still extensively and profitably carried on.

The importance of the study of natural history in our schools, especially the branch of Entomology, is beginning to be recognized, and I trust the day is not far distant when every public school will have its museum of natural history objects, where the children can be taught with the specimens before them the names and habits of the commoner mammals, birds, insects, and plants, with which they must constantly come in contact. Such studies would, in my opinion, strengthen the intellect and cultivate the memory and other faculties of the mind more thoroughly than many of the more abstract studies now specially designed for that purpose, while the practical value of such knowledge to the fortunate possessor, in after life, can scarcely be over-estimated. I am glad to state that at the Model Farm in Guelph the important study of insects injurious to agriculture is regularly taught, with the aid of a very fair collection of specimens.

The meeting of the Entomological Club of the American Association for the Advancement of Science was held this year at St. Louis, where some very interesting papers on destructive insects were read, and some curious facts in reference to insect life elicited. Our Society was ably represented by a member of our Editing Committee, Mr. E. B. Reed. It will doubtless be a source of gratification to you to learn that your President has again been honoured with the Vice-Presidency of that distinguished body of naturalists.

During the year some interesting additions have been made to our Entomological literature. which we can only now partially and briefly enumerate. Among the most valuable are the "Entomological Contributions," by J. A. Lintner; "Descriptions of Noctuidæ," by A. R. Grote; "Food Plants of the Tineina, with Descriptions of New Species," by V. T. Chambers, both published in the Bulletin of the United States Geological and Geographical Survey; "Manual of the Apiary," by A. J. Cook; on "Sexual Dimorphism in Butterflies," by Samuel H. Scudder; also several papers by the same author on fossil insects found in the Rocky Mountains, and in the Tertiary Beds at Quesnel, in British Columbia; "Insects Injurious to the Cotton Plant," with many plates, by Townend Glover; "On the Butterflies and Moths of North America," by Hermann Strecker. Several additional numbers of Edwards' "Butterflies of North America" have appeared, each one rivalling or surpassing its predecessor in the exquisite beauty of the plates illustrating the species described.

The publications of our own Society have been creditably maintained. Our Annual Report to the Department of Agriculture for the past year has been very favourably noticed, and our *Canadian Entomologist* has been issued regularly, its pages being well filled, chiefly with the records of original observations. The contributors to our last volume numbered no less than forty-five, and included the names of nearly every Entomologist of note on the continent. During the year we have published two handsome lithographic plates, one on wood-boring beetles, illustrating eight species; the other, which is printed in colours, exhibits the full-grown larva of that rare and interesting moth, *Samia columbia*. Among the most valuable papers I would mention those of W. H. Edwards, on the preparatory stages and dimorphic forms of butterflies; and one by the some author detailing the notable discovery of secretory organs on the hind segments of the larvæ of *Lycaena pseudargiolus*, from which is discharged a sweet fluid which induces the attendance of ants, who in return for the sweets thus provided them, defend these larvæ from their enemies. Our pages have been enriched also by valuable papers on the Noctuidæ and Pyralidæ, by A. R. Grote; on gall insects and other subjects, by Dr. H. Hagen; on Tortricidæ, by C. H. Fernald; on Tineina, by V. T. Chambers, besides many others, which time will not permit me to enumerate. During the past three months we have published in three portions a translation from the German of a very valuable paper by Dr. A. Speyer, on the Genera of the Hesperidæ, which paper, we trust, will be the means of bringing about such a rearrangement of the species contained in this interesting family of butterflies as will be acceptable to Lepidopterists, and at the same time, one likely to be permanent. It is through the kindness of Prof. J. A. Lintner, of Albany, that this translation has been supplied to us.

The practice of capturing our night-flying moths by the method of trapping, known to Entomologists as "sugaring," is still persevered in by most of our more active members, and with great practical results. Species which were formerly regarded as the greatest rarities, have in many instances been taken in large numbers, while many new discoveries have rewarded the most persistent workers in this interesting field of rescearch. As an example of the results of such work we would refer to a paper published in the *Canadian Entomologist* for November, 1877, on "Catocalæ taken at sugar, at Center, New York," by Dr. James M. Bailey.

During the past year that talented and energetic Entomologist, Prof. Townend Glover, of Washington, has, in consequence of ill-health, been obliged to resign his position as Entomologist in the Department of Agriculture. While deeply regretting the cause which necessitated the change, I am pleased to be able to record the graceful recognition of the importance of Economic Entomology by the heads of the Department in Washington, in appointing Prof. C. V. Riley to fill this high position, a man who has done so much by his valuable reports as State Entomologist of Missouri to popularize Entomology and to disseminate practical information in reference to our insect pests throughout this continent.

In our last Annual Report reference was made to the appearance of the first of a series of practical works on Economic Entomology by that renowned Entomologist, Andrew Murray, F. L. S., of South Kensington Museum, London, England. This work treated of some of the lower forms of insect life and their allies, and was to have been followed by seven additional volumes, all having a practical bearing on this subject, so important to the agriculturist. I then expressed the hope that this talented author might be spared to complete the series of useful works proposed, and thus leave behind him a lasting monument of his industry and devotion; but not long after this the sad news reached us that he had ceased from his labours—that he had been called away by death. Thus "man proposes but God disposes." It is commendable to lay our plans for usefulness in life, and to labour as opportunity offers with diligence, knowing that our time is short, and that the most useful life will soon—as far as this world is concerned—be at an end; but I love to think that when our work here is done, our happy lot may be to find in a purer state new fields of labour, where, free from the impediments which now obstruct our progress, we may study with much greater advantage the wonderful works of the Infinite Creator.

Thanking you for your kind attention,

I remain, yours very sincerely,

WILLIAM SAUNDERS.

After the reading of the Address, a vote of thanks was tendered to the President, coupled with the request that a copy be given for publication in the Annual Report of the Society.

The Election of Officers then took place, resulting in the appointment of the following gentlemen :—

President, Wm. Saunders, London.
Vice-President, Rev'd. C. J. S. Bethune, M.A., Port Hope.
Secretary-Treasurer. Jas. H. Bowman, London.
Council, E. Baynes Reed, London; Wm. Couper, Montreal; J. Pettit, Grimsby; J. M. Denton, London; G. J. Bowles, Montreal; Jas. Fletcher, Ottawa, and R. V. Rogers, Kingston.
Editor of Canadian Entomologist, Wm. Saunders, London.
Editing Committee, Rev'd. C. J. S. Bethune, Port Hope; E. B. Reed, London; G. J. Bowles, Montreal, and Rev'd. R. Burnet, London.
Librarian.—W. E. Saunders, London.
Library Committee.—E. B. Reed, J. M. Denton and H. B. Bock, all of London, with the President, Librarian and Secretary-Treasurer.
Auditors.—Messrs. Chas. Chapman and A. Puddicombe.

Mr. E. B. Reed gave a very interesting account of his recent visit to St. Louis, Missouri, where he went to represent the Entomological Society of Ontario, at the meeting of the Entomological Club of the American Association, for the Advancement of Science.

Succeeding the business portion of the meeting, an instructive hour was spent in the microscopic examination of insects and plants, with the aid of three excellent microscopes belonging to Messrs. Puddicombe, Denton and Saunders. Among the objects of special interest examined were mounted slides illustrative of the anatomy of insects, also egg clusters of the forest tent-caterpillar, *Clisiscampa sylvatica*, with mites at work destroying the eggs, specimens of the new carpet bug, *Anthrenus scrophulariœ*, and of the parasite on the cabbage butterfly *Pteromalus puparum.*

REPORT OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

Annual Meeting.

The Fifth Annual General Meeting of this Branch was held at the residence of H. H. Lyman, Esq., on Tuesday, 28th May, 1878, at 8 o'clock P.M.

The President read the following Report:—

Your Council beg to submit to the members the Fifth Annual Report of the Society's operations.

In doing so, your Council would record with pleasure the continued progress of the Society in every respect. The meetings have been interesting, and well attended; several valuable papers have been read, and many important observations on insect life have been placed on record. The cause of regret mentioned by your Council in last year's Report, though still existing, has been to some extent removed, for during the year our membership has increased, and the new members, your Council believe, will prove to be valuable acquisitions.

The following papers have been read before the Society during the year:

Original.

1. List of some species of *Geometridœ* new to Montreal. H. H. Lyman.
2. Description of larva supposed to be that of *Samia Columbia.* F. B. Caulfield.
3. Notes on *Deilephila Chœmenerii.* H. H. Lyman.
4. Notes on some species of *Coccinellidœ* found on the Island of Montreal. F. B. Caulfield.
5. On the Humble Bees found at Montreal. G. J. Bowles.

6. On *Anomis Xylina*, the Cotton Worm Moth. F. B. Caulfield.
7. Notes on *Genus Saperda* occurring at Montreal. F. B. Caulfield.
8. Spring rambles of an Entomologist at Hochelaga. F. B. Caulfield.
9. Migratory Insects. G. J. Bowles.

SELECTED.

10. Rough notes on Canadian Hymenoptera, from " Zoologist." D'Urban.
11. The Hearing of Insects. Sir John Lubbock.

The following books have been added to the Library :

DONATIONS.

The Spiders of Norway. 2 books.
Catalogue of Norwegian Insects. 4 books.
Some remarkable forms of Animal Life. 1 box.
Box Norwegian Insects and catalogue.
The above were from the University of Christiana.
11 Plates Lepidoptera, from W. Saunders, Esq., London.
Hinds' Essay on Wheat Insects, from the President.
Packard's Report, being one volume of the survey of Colorado ; from Dr. Hayden.
Annual Report of Parent Society.

PURCHASES.

Riley's Reports, Nos. 1, 3, 6, 7, 8, 9.
Fitch's " Nos. 1, 2, 6, 7, 8, 9.
Psyche, Vol. I.
Melsheimer's Catalogue of Coleoptera.
Insects of Ancient America, Scudder.

Your Council would note, that at the request of the Horticultural Association of Montreal, two papers have been prepared by members of this Society for publication in the Annual Report of the Association for 1877. One of these, entitled "The Importance of Entomology to Fruit Growers," is by the President, the other, " On Borers," is by Mr. Caulfield. These, it is intended, will be followed by others in future Reports. Your Council trusts that the intercourse between the Association and the Society will continue, and prove beneficial to both.

Your Council would mention that one of our members, Mr. Couper, has left Montreal on a trip to the North Shore of the Gulf of St. Lawrence, for the purpose of studying the preparatory stages of the Northern butterflies, and procuring their eggs and larvæ. Your Council feel satisfied that the members will wish him every success in this effort to advance Canadian Entomology.

The compilation of the Montreal catalogue is still progressing, many species new to this locality having been added during the year. The number on the list is now between 800 and 900.

The whole respectfully submitted.

GEO. JNO. BOWLES,
President.

The Report, having been read, was received and adopted, after which the election of officers for the ensuing year took place with the following result:—President, G. J. Bowles ; Vice-President, Robert Jack ; Secretary-Treasurer, G. B. Pearson, jr ; Curator, G. H. Bowles, Council, M. Kollmar, H. H. Lyman, F. B. Caulfield.

After a very pleasant meeting, the members adjourned.

G. B. PEARSON, JR.,
Secretary.

ANNUAL MEETING OF THE LONDON BRANCH.

The Annual Meeting of the London Branch of the Entomological Society of Ontario was held at the residence of Chas. Chapman, Esq., on the evening of Tuesday, January 15th, 1878.

A communication from the Art Loan Exhibition Committee was read, requesting that some of the insects belonging to the Society be placed on exhibition at the Mechanics' Hall during the time the Art Exhibition remained open. This was unanimously granted, the members feeling glad to have the opportunity of aiding exhibitions of this sort, and at the same time of bringing some of the Society's work more prominently before the public, also of fostering any interest that might be felt in our favourite study.

Specimens of Nephopteryx Zimmermani, presented by Mr. Saunders caused much interest on account of the reported destruction they had caused among the white and red pine forests in some parts of the United States.

Many other subjects for discussion presented themselves during the evening, and the proceedings were closed by the election of officers for the ensuing year, with the following result:—President, J. M. Denton ; Vice-President, A. Puddicombe ; Secretary-Treasurer, Jas. H. Bowman; Curator, Chas. Chapman ; Council, H. Bock, Wm. Saunders and Jos. Williams ; Auditors, H. Bock and Wm. Saunders.

After which the meeting adjourned.

REPORT OF THE COUNCIL.

The Council of the London Branch of the Entomological Society of Ontario beg to submit the following report :

The Branch has had a successful season. Its meetings having been well attended by our local entomologists. We have felt the pleasure and profit there is in being able to assemble in our monthly meetings, to compare notes on our own work and to interchange our views on such new facts as are being continually brought into notice by the more ardent students in entomology.

Our spring meetings were specially characterized by many observations on *Clisiocompa sylvatica* and some discoveries made regarding the state of the caterpillar in the egg during the winter season. Interesting notes have also been brought under our notice in reference to the life histories of other insects.

During the year many specimens have been added to our already large collection. A portion of this collection was placed on exhibition during the winter in the Mechanics' Hall, at the Art Loan Exhibition, and proved a very interesting feature in the display.

The financial affairs of the Branch are very satisfactory, there being a balance, though small, in our favour, We look over the work of the year with pleasure and anticipate that of the next with like feelings.

Submitted on behalf of the Council, by

JAS. H. BOWMAN,
Sec.-Treas.

ANNUAL MEETING OF THE ENTOMOLOGICAL CLUB OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Club met pursuant to notice, at 2:30 on Tuesday afternoon, August 20, 1878, at room 17, The Lindell Hotel, St. Louis, Missouri.

The President, Mr. J. A. Lintner, of Albany, in the chair. In the absence of the Secretary, Mr. B. Pickman Mann, Prof. A. G. Wetherby, of Cincinnati, was appointed Secretary *pro tem.*

The President then delivered his

ANNUAL ADDRESS.

Gentlemen of the Entomological Club:

For the honour which you were pleased to confer upon me, at your last meeting, when I was unable to be with you, in calling me to preside over you, I am fully appreciative, and would return my grateful acknowledgments. While I well know that there are several among you who far better deserved the honour of succeeding to the chair vacated by my illustrious predecessor, yet I would interpret your selection as a tribute to my devotion to our loved science, and to my earnest desire to aid in its progress to the extent of my humble ability.

On these annual gatherings, marking the lapse of a period signalized by progress equalling, even surpassing that of a decade but a few years ago, it would seem fitting and proper that a comprehensive view of that progress should be given. But this has been so ably done by one of our number, and you have had it presented in the pages of *Psyche*, that whatever I might say in this direction, would be but repetition.

Permit me then, instead, to refer to some evidence of progress in American Entomology, shown within the recollection of several of us here present. Going back forty years, very little was known of our abundant insect fauna, except of the Coleoptera, an order which enjoyed the good fortune of being an attractive one, easy to collect in and prepare for the cabinet, and which early enlisted in its study earnest students, who have since lent honoured names to the annals of American science. Thus, in 1835, in Harris' List of the Insects of Massachusetts, the names of 994 Coleoptera are given, and but 140 Lepidoptera. Of the latter, 34 are butterflies, four of which are erroneously referred to European species: among these only three species of Hesperidæ are mentioned. Seventeen species of Noctuidæ are recorded, with the additional note of "96 unnamed species." There are also the names of 7 Geometers, 1 Pyralid, 1 Tortrix and 6 Tineids. How great an advance upon this in our knowledge of forms is shown in the Crotch Check List of 7,450 species of Coleoptera, in the Grote Check List of 1,132 species of Noctuids (already quite incomplete from the species subsequently made known), and in the Edwards' Catalogue of 506 species of Butterflies (110 of which are Hesperidæ). I often recall, as I am reminded of past progress, a request of Dr. Fitch, soon after the commencement of his Reports, for my careful attention to the Catocalas, for the authorities of the British Museum were, he thought unnecessarily, multiplying species. He did not believe that we really had over a half dozen species. To-day we number over 90 accepted species.

At the time to which I have referred, very few—perhaps not over a score (my limited knowledge of the Coleoptera must be my excuse if I err)—of the histories of our insects were known; now, we may count by the hundred those of which we know the transformations and the life histories more or less complete. Some of these, thanks to the labours of Edwards, Riley, Scudder, Walsh, and others, have been charmingly wrought out, and are honourable contributions to science.

The list of working Entomologists is rapidly enlarging, and with the consequent diffusion of a knowledge of their purposes and their results, we have reason to believe that the day is not far distant when the opprobious prefix of "crazy" will not invariably be associated with "bug-hunter." In the last edition of the Naturalists' Directory, the names of 281 persons are recorded who are making Entomology their study in North America. It is probable that a full list would be increased by at least 25 per cent. extending the number to 350.

With so large a number of working Entomologists, we would be justified in expecting larger annual contributions to our literature. It would seem to me but a moderate estimate that one-third of the number should possess the ability of making such careful observations and of collating them in such a form that they would prove acceptable and valuable contributions to our knowledge. While we know so little of the transformations of our species, the habits of their larvæ, and imagines, their geographical distribution—in short, the numerous details entering into and composing their life histories, there is scarcely a new fact relating to these particulars which is not worthy of being placed on record in the pages of our Entomological journals, which will gladly give them place. It has been stated that there are but about thirty Entomologists in the United States and the Dominion of Canada who are in the habit of publishing the results of their observations and studies. The last volume of the *Canadian Entomologist* presents a list of forty-five contributors; and Mr. Scudder, in his review of the work done during the year 1877, to which reference has been made, gives an account of the publications of forty-one writers, seven of whom have discussed injurious insects only. We wish that this latter number had been much larger.

A marked improvement has been shown in the number, extent and character of Entomological collections, both in public institutions and private hands. It is most earnestly to be hoped that the growing appreciation of the value of these collections may demand and ensure their proper care and future preservation. To this end it is very important that each individual possessing a valuable private collection (and there are now a respectable number distributed through the several States which contain 5,000 examples) should make such arrangements for its disposition and preservation after his decease as may, within a reasonable extent, ensure its perpetuity. The authoritative statement which has been made that the extremely valuable collections of Drs. LeConte and Horn will at some future day be added to the collection which the ability and zeal of Dr. Hagen has built up at the Cambridge Museum, is highly gratifying intelligence. And in this connexion, let me endeavour to impress upon each one of you the service which you may render to science by availing yourself of every opportunity to urge upon those who have voice in the erection of buildings devoted to scientific collections, that a primary consideration be that they be made fire-proof.

The literature of our science has already become quite respectable, and its collection on our shelves forms no inconsiderable a library. The eleven volumes of the American Entomological Society represent a large amount of earnest and thorough work. The nine volumes of the *Canadian Entomologist* are replete with interest and instruction. The numerous papers scattered through the pages of the Reports of the Peabody Academy of Science, Proceedings of the Boston Society of Natural History, Annals of the Lyceum of Natural History of New York, Proceedings of the Philadelphia Academy of Natural Science, Bulletin of the Buffalo Society of Natural Science, Proceedings of the California Academy of Natural Science, and others, fully illustrate the earnestness with which Entomological study is being prosecuted, and give large promise of a brilliant future. The exquisite illustrations of the "Butterflies of North America" are a credit to our country, being fully equal to the best work of the class in Europe. The publications of LeConte have given him high place among the honoured names of the fathers of American Entomology, while the writings of Hagen, Grote, Scudder, Packard, Horn, Cresson, and Uhler, represent no inconsiderable portion of the progress upon which we are congratulating ourselves. Nor can I omit reference to our European friends—to Loew, Osten Sacken, de Saussure, Speyer, Zeller, Mœschler, Butler, and others, who are freely lending us their valued aid in the descriptions of forms too numerous for our few hands, and in the solution of problems which require for their determination the study of the entire insect fauna of the eastern hemisphere in connection with our own.

The most gratifying feature, perhaps in the report of progress which I am able to present to you, is the aid which the General Government is now extending to Entomological explorations and investigations, in placing scientists in the field and in the publication of their results. Two years ago, the occupant of this chair felt called upon to express to you his sorrow, disappointment, indignation, that Congress had declined to accede to the memorials presented it, asking its recognition and acceptance of the service which applied Entomology was in a condition to render. Now, it is a cause of congratulation that the Department of Agriculture has selected as its Entomologist one whose training in the school of economic Entomology for the past ten years has specially qualified him for the responsible position he occupies; and we have the additional gratifying assurance that the Secretary of the Department is in full sympathy with our aims.

In conformity with a precedent long since established in Europe, our Government has honoured itself while honouring science, in seeking to add to the productive wealth of the country through a control of the insect depredations inflicted upon our people, to the extent of enormous annual losses, and at times, poverty and starvation. The two special Commissions which have been already appointed, it is understood are, ere long, to be followed by others. The published results of one year's labour of the Locust Commission is on our hands. An inspection of the matter crowding its 772 pages will, I am sure, convince any one competent to judge, of the wisdom of the appropriation made for its support. The Cotton-worm Commission has already actively entered upon its work.

To Government aid we owe the publication of Packard's Monograph of Phalænidæ —a beautiful quarto of attractive typography and ample and excellent illustration; Thomas' Acrididæ of North America, with 260 quarto pages and illustrations; the Reports on Hymenoptera, Lepidoptera, Coleoptera, Hemiptera and Orthoptera in Lieut. Wheeler's Surveys west of the 100th Meridian, of 331 quarto pages and several chromo lithographic plates; and to Reports on several orders of insects by Chambers, Grote, Hagen, Osten-Sacken, Packard, Scudder, Thomas and Uhler, in the Annual Reports and the Bulletins of the Hayden Survey of the Territories.

The liberality displayed by our Government in the publication and gratuitous distribution, to those whose scientific labours render them worthy recipients, of investigations in other departments of Natural Science—in Geology, Palæontology, Mammalogy, Ornithology, Ichthyology, Botany, etc., deserves our most earnest commendation. The facility of publication thus afforded to meritorious work almost evokes the envy of some of our European friends.

In conclusion, permit me to commend to the members of the club the biological study of our insect forms. It is attractive; it is simple in many of its phases; it is of great practical utility; it is a field where all can find abundant work, and one in which some of those questions which are engaging the attention of zoologists in other departments; may best find their most ready answer. Let no one be satisfied with the simple possession of a large and well-arranged cabinet of insects. If to collect and own it be a source of pleasure, often beyond expression, then science may demand at his hands that he should aid in extending its boundaries in return; and in no better way can this be done than in working out the life histories of our species, beginning with those with which we hold the more intimate relationship. Let descriptions of forms remain, except in exceptional cases, for those who have special fitness and opportunity for the work; and systemisation for him who, like the poet, *nascitur non fit*, that kaleidoscopic manipulation of genera and the higher groups may cease to bewilder, perplex and dismay.

In illustration of what may be done in the study that I commend to you, I would refer to the labours of Mr. W. H. Edwards in working out the histories of some of those butterflies which appear under different forms at different seasons of the year. Some of the results are known to you, and I am sure that you regard them as among the most valuable recent contributions to Entomology. The untiring zeal with which the work has been prosecuted and is being continued deserves the commendation which it has received from the most eminent European Entomologists, and the success with which it has been crowned.

Gentleman, I trust that our assemblage at this time may not only conduce to the interests of our science, but also render its pursuit more pleasant to us, through the privilege it affords of personal acquaintance, comparison of observations, interchange of opinion, and the strengthening of those bonds of sympathy which should (they do not always) unite those who labour in our common cause.

On the motion of Mr. A. R. Grote, of Buffalo, a resolution was passed requesting the *Canadian Entomologist* to publish the President's Address and the proceedings of this meeting.

Mr. E. B. Reed, of London, Canada, associate editor of the *Canadian Entomologist*, apologized for the unavoidable absence of the Vice-President, Mr. Wm. Saunders, and stated that the editor of the *Canadian Entomologist* would be most happy to comply with the wishes of the Club respecting the publication of the proceedings of the meeting.

Mr. A. R. Grote exhibited some insects from Georgia—*Callosamia angulifera*, *Eacles didyma*, *Lagoa pyxidifera*, *Heterocampa obliqua*. In the South he had found that *Actias luna*, *Samia cecropia*, *Telea polyphemus* and *Saturnia io* were double-brooded, while on the contrary, *Citheronia regalis* was only single-brooded.

Prof. Wetherby stated that in his section, and in other parts also of the North-Western States, many of the above-named moths were also double-brooded.

Miss Emily A. Smith, of the Scientific Association of Peoria, Ill., submitted to the meeting a most interesting account of *Lecanium acericorticis*, Fitch, a bark-louse, that had seriously damaged the maple trees, both hard and soft, in Illinois and the adjoining States. The whole life history of this pest had been most carefully worked out by Miss Smith, who also exhibited a very complete set of microscopical preparations of the insect in its various stages, and also of a parasitic *Chalcid* discovered by her. One important point noted was the migration of the bark-lice on the approach of the fall from the leaves to the trunk of the tree, on which, however numerously they might be found together, their position was always lengthwise with the trunk. In the South the insect was doubtless double-brooded. . Dr. Fitch had briefly described the insect many years ago, but Miss Smith had been enabled to work out many hitherto unknown points in its history.

Various experiments have been tried to destroy the lice, but Miss Smith had found the best success in using a Babcock or Chamber's Fire Extinguisher, charged in the usual way, with the addition of a little crude carbolic acid, in the proportion of about one large spoonful to six gallons of water. By means of the Extinguisher she was able to reach even large trees, the cost being about 20 cents per tree. The remedy should be applied before the insects become too old, otherwise a stronger preparation of carbolic acid was necessary, and in consequence the trees might possibly suffer somewhat.

Mr. Thos. Bassnett, of Jacksonville, Florida, had listened to the admirable account with very great interest, inasmuch as in the South the culture of the Orange tree, in which he was largely interested, was seriously threatened with extermination by the ravages of a bark-louse similar to that described by Miss Smith, and he was glad to hear that a remedy could be so successfully applied.

Prof. C. V. Riley, of Washington, D.C., spoke, thanking the lady for bringing this subject before the meeting, and complimenting her on the discoveries she had effected. He fully corroborated the statements made as to the extent of damage caused by bark-lice, especially those affecting the Orange in the South. He strongly advocated the use of the "Extinguisher" in similar cases, but recommended that kerosene should be tried instead of carbolic acid; it would, he thought, be found of less injury to the trees, and would destroy the insect for some time after the formation of the scale, which the carbolic acid would not do. It should not be applied in excess; the ordinary proportion should be about one part kerosene to twenty of water.

The whole topic was very fruitful of discussion, and Miss Smith was much thanked for her paper and for the drawings and microscopical preparations that accompanied it.

On motion of Prof. Riley, seconded by Mr. Reed, a resolution was carried that a committee be appointed to prepare a report, and submit it to the next session of the Club, in regard to the quorum of members necessary to transact business.

The Chairman appointed the mover and seconder and Prof. A. G. Wetherby as the committee.

Prof. Riley gave a brief abstract of some of the Entomological papers he proposed to read to the Association.

(1). Notes on the life history of the blister beetles, and on the structure and development of the genus *Hornia*, Riley.

(2) On the larval growth of *Corydalis* and *Chauliodes*.

(3) On the means by which silk-worms issue from their cocoons.

Hornia was parasitic on the common humble-bee, and had been successfuly identified by careful study, although in several important points it differed from the *Meloidœ* to which it belonged.

The further larval history of *Corydalis cornutus* was given by Mr. Riley, and was most interesting, especially to those members who had listened to Mr. Riley's first descriptions of this curious insect at the Detroit meeting. Mr. Riley had been very successful in elaborating the various points of difference between *Corydalis* and *Chauliodes*.

In discussion it was stated that the somewhat peculiar name of the "Hellgrammite Fly" for the *Corydalis* had been for many years in common use both on the Upper and Lower Mississippi; and that the equally curious name of "Dobson" was given to its larva, which was largely used for bait by the river fishermen.

On the paper relating to silk-worms reference was made to Dr. Packard's recent theory on certain spines on the wings of Bombycidæ, which he stated were of service in assisting the exit of the insect from the cocoon.

Mr. Riley, in combatting this idea, showed how in almost every case the silk was spun in figures of 8, which would easily yield to pressure, especially as in most cases of fluid (wrongly termed bombyc acid) was emitted, and the silk thus rendered more pliable. His idea was that the peculiar make-up of the cocoon rendered it more yielding for the exit, and that though the insect usually emerged at the end of the cocoon, there seemed to be no reason why, if it chose, it could not find an egress equally well at the side of the cocoon.

Several minor matters were discussed, and the Club adjourned at the call of the chairman.

AUGUST, 21st, 1878.

The Club met in the same place at three o'clock P.M., the President in the chair.

There was a much larger attendance than yesterday of members and those interested in Entomology.

The first order of business was the reading of the Report of the Special Committee appointed yesterday. Mr. Reed presented the report.

The committee to whom was referred the question of the constitution of a quorum, beg to report as follows:—

Whereas it is most desirable in the interest of the Club that a definite and permanent character should be given to all its proceedings, and that nothing should be left undone which would tend to establish complete confidence in the manner of transacting the business of the Club;

Your committee therefore recommend that the constitution be amended by providing

(1.) That no business of the Club shall be transacted unless there are present a quorum of ten persons, who shall have been enrolled as members of the Club at least one year previous to the then session.

(2.) That when motions shall have been carried by the Club, the same shall not be rescinded at any subsequent meeting unless there be present as many members as were present at the date of passing such motions.

Your committee recommend that this report be printed and a copy sent to each member of the Club, and that it be brought up for discussion at the next annual session of the Club.

C. V. RILEY,
A. G. WETHERBY,
E. BAYNES REED.

August 21, 1878.

The report was unanimously adopted.

The Club then proceeded to the election of officers.

On motion, duly carried, the following gentlemen were re-elected officers for the ensuing year:

Mr. J. A. Lintner, Albany, N.Y., - - -	President.
Mr. Wm. Saunders, London, Ont., - - -	Vice-President.
Mr. B. Pickman Mann, Cambridge, Mass., - -	Secretary.

The President returned thanks for the honour conferred upon him. He then addressed the Club, giving a most interesting description of the success that had attended his efforts and those of his co-labourers in collecting Noctuidæ during the season of 1877, by the means known as "sugaring." By reference to a list given on page 120 of his "Entomological Contributions," No. 4, it would be seen that there had been captured eighty-six species, not one of which had hitherto been taken in the Albany district. Nearly all of these had been found in the famous Center locality. He most graphically described his manner of working by this method, and strongly recommended its trial to all the members.

Prof. Wetherby made some remarks on this attractive means of capture, which was continually bringing under the notice of Entomologists specimens hitherto unknown or considered as most rare. It was a question if there were any species which are in reality rare, their seeming rarity resulting from our not knowing when, where and how to collect them.

Miss Smith described a collecting bottle of her own device, by which, on touching a spring, the cover flew back and the insects could be readily caught in the receptacle. Its chief recommendation was that it could be managed by one hand, leaving the other at liberty for holding the lantern.

Mr. Reed advocated the fastening of the lantern to the waist by a belt, thus leaving he hands at greater freedom to use the bottles and boxes.

The President said he had found that in using the ordinary bull's eye lantern the fingers could be thrust through the wire handle in such a manner that their ends and the thumb were free for use in withdrawing, holding and replacing the stopple of the collecting bottle. The lantern in hand enabled him more readily to adjust the light, and he had found that it was often more desirable to throw the penumbra rather than the full light upon the tree, many insects often fleeing from a strong light.

Miss Smith gave an account of the damage done to the oaks in Wisconsin and Illinois by the larvæ of a little Tortrix, *Argyrolepia quercifoliana*, Fitch.

A very interesting discussion took place on the question of instinct or reason displayed by insects, and many curious instances were cited proving that instinct and reason differ in degree and not in kind.

The meeting then adjourned.

EXPERIMENTS ON THE COLORADO POTATO BEETLE.

(*From correspondence in the Canadian Entomologist.*)

DEAR SIR,—

As correspondence is invited respecting the habits, localities, occurrence, etc., of insects, I take the liberty to offer a few remarks on the Colorado Potato Beetle, *Doryphora 10-lineata*.

Wishing to ascertain if the domestic fowl were likely to be of any value in reducing the numbers of *D. 10-lineata,* I procured the assistance of a neighbour who kept fowl (I do not keep them myself), and the following is the result of our experiments:

Our first experiment was to offer both larvæ and beetles to the fowl, but they refused to touch them, and acted as if somewhat afraid. Next we mixed the insects with the corn and other food that was given them, but they refused even to eat the corn for a time; by-and-by, however, they began to eat the corn and soon lost all fear of the insects, although they still refuse to eat any. After a few days, by keeping the insects in their food all the time, some of the bravest of the hens began to eat a few insects, and it was not long before the rest joined them, and in a few days more they appeared to relish the beetles about as well as the corn. Up to this time I did not observe any of the fowls eat a beetle from the potato vines, but they now began to do so, and we were obliged to put them in their food no longer. After this the beetles were so reduced in number in this garden that they did no material damage.

It would seem from the above that although the beetles were naturally repugnant to the domestic fowl, yet an appetite for them may be acquired. If the substance of the above has been published I was not aware of it, and give it for what it is worth.

I noticed in the last report of the Entomological Society of Ontario, in the experiments on the Colorado Potato Beetle, by W. Brodie, the remark that "it is very doubtful if *Doryphora,* either in the larva or imago state, will feed on *Solanum dulcamara* or *Datura stramonium.*" I have found the insect in both these stages plentifully on *S. Dulcamara* which grows quite abundantly near this place, and they wholly consumed both leaves, flowers and fruit of every plant in this vicinity. They were more abundant on these plants than on my potato plants, which were not more than five rods from some of the former.

J. E. BATES, South Abington, Mass.

DEAR SIR,—

Mr. Bates is quite right in saying *Doryphora* will eat *Solanum dulcamara* and *Datura stramonium;* they have preferred these to tomatoes in my garden. A friend found them eating *Hyoscyamus*. The present season seems exceedingly favourable to production of *Nematus* and other grubs destructive of the currants and gooseberries.

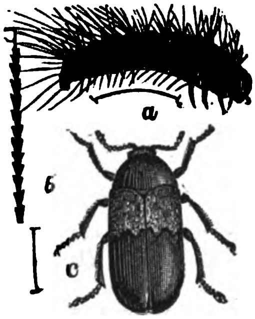
H. H. CROFT, Toronto, Ont.

SOME OBSERVATIONS ON THE BACON BEETLE DERMESTES LARDARIUS.

BY CAROLINE E. HEUSTIS, ST. JOHN, N. B.

(From the Canadian Entomologist.)

Having read in the Report of the Entomological Society of Ontario for 1877 an article by Prof. J. T. Bell, of Belleville, Ont., entitled "How to Destroy Cabinet Pests," I thought it might not be unprofitable to record my own observations on *Dermestes Lardarius*.



In the accompanying figure 1, both beetle and larva are shown, magnified; the hair lines placed by the side of each indicate the natural size.

Early in the summer of 1876 I captured four beetles, three males and one female, and placed them in a glass jar with a piece of the meat on which I found them feeding. I observed the female deposit a number of eggs on the meat, but before any were hatched I left home, and was absent about five weeks. On my return I found a large and flourishing colony of larvæ, most of them full grown.

My object in rearing these insects was not to study their natural history, but to find out the best means to destroy them. I put a piece of camphor gum in the glass as a first experiment. The effect on them was very slight. They appeared a little uneasy at first, but in a minute or so commenced crawling over the camphor quite unconcerned. I had heard of a clothier who rolled tallow candles up in webs of woollen cloth to preserve them from the attacks of the "moths," and I resolved to try its effects on *Dermestes* larvæ. With this view I put a small piece of tallow in the glass, and the effect was almost instantaneous. It was quite ludicrous to see the stampede which commenced. Never did insect evince more terror or disgust than did these pests. They fled pell-mell to the side of the jar, but as there was no way of escape, they were obliged to yield to "circumstances over which they had no control." The closest observation failed to detect one going near the tallow. They remained for several days huddled together by the side of the jar in a confused mass.

Satisfied with my experiment, and being very busy at the time, I put the jar away, and on looking at it about a fortnight afterward, I found but one beetle and that one *dead*, of all that large family. As all the larvæ and three of the four beetles had disappeared and "left no trace behind," I naturally concluded that they had been driven by starvation to prey upon each other. There was no possibility of escape from the jar, and my conclusion seems reasonable, even if I cannot prove it.

I have ever since kept tallow in trunks or presses where there are woollen garments, blankets or furs, and I have had nothing eaten up to the time of writing. In preparing my boxes for mounted specimens, I put bits of tallow between the strips of cork and cover with paper gummed to the sides of the box, and I have not had a single specimen injured by *Dermestes* or any other cabinet pest. As tallow is cheap and can be obtained in either town or country, I would heartily recommend it to both housekeepers and naturalists. To the former it would be much better and less disagreeable than the snuff, tobacco, pepper and other preventatives which are put on furs with such unsatisfactory results. Although such a remedy as Prof. Bell recommends might do for the cabinet, it would be neither pleasant nor safe to have about our clothing.

MAMMALS ATTRACTED BY SUGAR.

BY JAMES S. BAILEY, A. M., M. D., ALBANY, N. Y.

It has not been supposed that animal life would be attracted by sugar, but while sugaring for Lepidoptera the contrary has been proven. On a number of occasions we have taken deer mice while in the act of feeding on sugar, and more recently we have taken a flying squirrel while lapping the sweets of a sugared patch.

Not long since, in making our rounds while sugaring we discovered a skunk endeavouring to taste the sugaring, and so intent was he that our approach was unobserved until a piece of dead wood was hurled at him, when he reluctantly left. The throwing of a second missile quickened his pace and caused him to distribute his perfumery, which rendered the air rather more fragrant than Lubin's Ext. of new-mown hay. It is unnecessary to state that our recreation for the evening was at an end.

We have frequently taken at sugar tree toads and various species of Coleoptera. A Texan correspondent says it is not uncommon for him to take at sugar Scorpions, and also species of Lizards, which are numerous in that latitude.

ON WINTERING THE CAMBERWELL BEAUTY—*Vanessa Antiopa.*

BY C. G. SIEWERS, NEWPORT, KY.

This beautiful diurnal—the "Camberwell Beauty" of England, and very inappropriately styled the "Mourning Cloak" by Americans, for is it not clothed in a mantle of imperial purple, fringed with gold lace?—is well known to hybernate. It is occasionally found in stone piles in the winter, but I think its most common hiding-place is in the culvert walls of our country roads and turnpikes. It requires a cold, moist, dark place, or it will dry up.

Capturing a fine female on the 9th of October, 1876, I concluded to winter it. Placing it in a net cage with a dish of apple, sugar and water, I supposed my share of the performance over. It fed for several weeks, then fluttered a good deal and died the beginning of December. It had fairly dried up. This showed bad management. Last fall, on September 7th, passing a tree sugared the night before, I captured another female. This one I placed in a paper box eight inches square and high, removed the core of half an apple, sliced off a bit of the round side to steady it, placed it in a small two-inch dish, covered with sugar, and filled up with water. Once a week I renewed the water and sugar. It placed itself on the side of the box, directly over and within reach of the dish, and however I moved the apple I always found that it followed it round.

It evidently fed on warm days, but never opened its wings. I kept it in an up-stairs, cold room, where water would freeze, but still not as cold as out doors. It allowed me to handle it, and would lie flat on my hand without movement. In February I thought there were symptoms of weakening. It no longer perched on the side of the box, but remained on the bottom, leaning over very much to one side.

Placing it in sunshine the last week of February, it began to open its wings little by little with short jerks, as if the tendons were loosening. When half open it was put away again. On the 11th of March, a warm, cloudy day, I took it on my finger to an open window. While looking at its clear eyes the sun suddenly shone out, and the next moment it was gone. I had proposed to try and find a mate for it, but concluded to keep it till others were flying, and then take it to its old neighbourhood and let it go. As it took the direction of its place of capture I was pretty sure to see it again, and found it four days after in a sugar camp in the same woods. I recognized it at once by a bad bend in the tip of the wings caused by a jam of the dish slipping on it.

On the 27th of March, two weeks later, the first *antiopa* appeared. I have so far failed to take the larva, but have just seen several imagines in a willow thicket, which gives me hope. They are usually rare, but some years their numbers make them a nuisance. Their colour is dark purple with strong black spines. Food plants—Lombardy poplar and willow

ON A SPECIES OF BARK LOUSE AFFECTING THE TULIP TREE.

BY A. J. COOK, LANSING, MICH.

From the Canadian Entomologist.

On page 218 of the "Revised Manual," in speaking of other sources than flowers from which bees collect sweets, I remark that I have seen the bees thick about a large bark louse, which attacks and often destroys one of our best honey-trees. This is an undescribed species of the genus *Lecanium.*

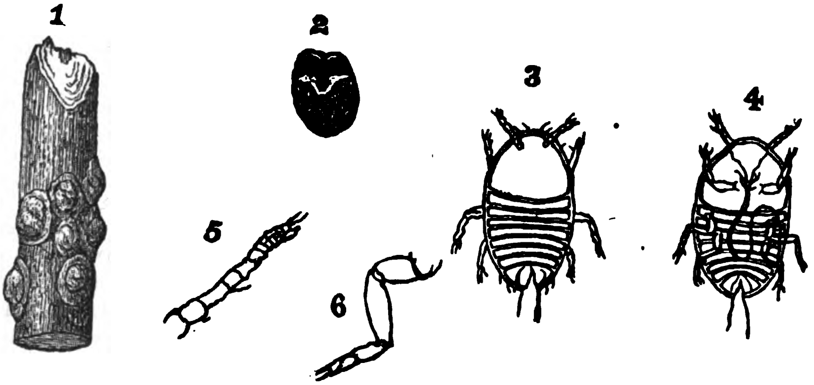
In the summer of 1870, this louse, which, as far as I know, has never yet been described, and for which I propose the above very appropriate name, *tulipiferæ*—the *Lecanium* of the tulip tree—was very common on the tulip trees about the College lawns. So destructive were they that some of the trees were killed outright, others were much injured, and had not the lice, for some unknown reason, ceased to thrive, we should soon have missed from our grounds one of our most attractive trees.

Since the date above given I have received these insects, through the several editors of our excellent bee papers, from many of the States, especially those bordering the Ohio river. In Tennessee they seem very common, as they are often noticed in abundance on the fine stately tulip trees of that goodly State. In the South this tulip tree is called the poplar, which is very incorrect, as it is in no way related to the latter. The poplar belongs to the willow family; the tulip to the magnolia, which families are wide apart.

Whenever the tulip-tree lice have been observed sucking the sap and vitality from the trees—there the bees have also been seen, lapping up a sweet juicy exudation, which is secreted by the lice. In 1870 I observed that our tulip-trees were alive with bees and wasps, even as late as August, though the trees are in blossom only in June. Examination showed that the exuding sweets from these lice were what attracted the bees. This was observed with some anxiety, as the secretion gives off a very nauseating odour.

The oozing secretions from this and other lice, not only of the bark-louse family (Coccidæ), but of the plant-louse family (Aphidæ), are often referred to as honey-dew. Would it not be better to speak of these as insect secretions, and reserve the name honey-dew for sweet secretions from plants, other than those which come from the flowers.

The fact that this insect is yet undescribed—that it attacks one of our best honey trees and is the source of a so-called honey-dew, leads me to append the following description, with illustrations.



NATURAL HISTORY OF THE LECANIUM TULIPIFERÆ.

☞ The fully developed insect, like all bark-lice, is in the form of a scale (fig. 1), closely applied to the limb or twig on which it works. This insect, like most of its genus, is brown, very convex above (fig. 1), concave beneath (fig. 2). On the under side is a cotton-like secretion, common to all of the genus *Lecanium*, which serves to enfold the eggs.

Underneath the species in question are two transverse parallel lines of this white down (fig. 2); one of them, probably the anterior, is nearly marginal, and is interrupted in the middle; while the other is nearly central, and in place of the interruption in the middle it has a V-shaped projection back or away from the other line. The form of the scale is quadrangular, and not unlike that of a turtle (fig. 1). When fully developed it is a little more than $\frac{3}{16}$ of an inch long, and a little more than $\frac{2}{3}$ as wide.

Here at Lansing, the small, yellow, oval eggs appear late in August. In Tennessee they would be found under the scales in their cotton wrappings many days earlier. The eggs are $\frac{1}{40}$ of an inch long, and $\frac{1}{65}$ of an inch wide. These eggs, which are very numerous, hatch in the locality of their development, and the young or larval lice, quite in contrast with their dried, inert, motionless parents, are spry and active. They are oval (figs. 3 and 4), yellow, and $\frac{1}{25}$ of an inch long and $\frac{1}{40}$ of an inch wide. The eyes, antennæ (fig. 5), and legs (fig. 6), are plainly visible when magnified 30 or 40 diameters. The 9-jointed abdomen is deeply emarginate, or cut into posteriorly (fig. 3), and on each side of this slit is a projecting stylet or hair (figs. 3 and 4), while from between the eyes, on the under side of the head, extends the long recurved beak (fig. 4). The larvæ soon leave the scales, crawl about the tree, and finally fasten by inserting their long slender beaks, when they so pump up the sap that they grow with surprising rapidity. In a few weeks their legs and antennæ disappear and the scale-like form is assumed. In the following summer the scale is full-formed and the eggs are developed. Soon the scale, which is but the carcass of the once active louse, drops from the tree, and the work of destruction is left to the young lice, a responsibility which they seem quite ready to assume.

In my observations I have detected no males. Judging from others of the bark-lice, these probably possess wings, and will never assume the scale form, though Prof. P. R. Uhler writes me that some of the males are apterous. He says that it is very important to know and record the males, and that the genera are hardly determined without them.

REMEDIES.

If valued shade or honey trees are attacked by these insatiate destroyers, they could probably be saved by discreet pruning—cutting off the infected branches before serious injury was done, or by syringing the trees with a solution of whale oil soap,—or even common soft soap would do—just as the young lice are leaving the scales. It would be still better to have the solution hot. Whitman's Fountain Pump is admirable for making such applications.

Fig. 1 is slightly magnified; the others are largely magnified.

THE BEATING NET.

BY JAMES S. BAILEY, A. M., M. D., ALBANY, N. Y.

The uses of the beating net are obvious and can at once be appreciated in the collecting of Coleoptera and larvæ. A convenient and simple form is here presented, with directions for its construction.

This particular form of net was invented and presented to me by my friend, Mr. T. B. Ashton, of Tonganoxie, Kansas, who has not only distinguished himself as a Coleopterist, but has shown himself to be an excellent mechanic.

By grasping the net with the left hand, as shown in fig. 3, thrusting it under a shrub, and giving the bush a quick shake, or blow with a walking stick, every living thing upon it will instantly fall upon the apron of the net. If Coleoptera, they can be secured with the fingers or a small net held in the other hand for that purpose. If caterpillars, they can be gently rolled into a receptacle prepared for them.

The frame work is made of well seasoned hickory. The sides, A B and G I, are composed of strips 37 inches long and $1\frac{1}{4}$ wide at the ends A and G, and tapering uniformly until they are $\frac{5}{8}$ of an inch wide at the other ends, B and I. Each piece should be ⅛ inch thick when dressed. After these pieces are steamed or boiled in water until thoroughly pliant, the wider ends A and G can be placed together and securely fastened in a vice, the free ends B and I separated widely and a block of wood forced between at the point E, and securely fastened, while the ends B and I can be secured with a piece of strong twine until dry enough for the frame to maintain its shape. Then the sides should be sand-papered until smooth and two holes board in each piece for the rounds G C and H D to pass through; for this purpose a half-inch bit will be sufficient, its point being inserted in the stick ¾ of an inch from the end of the widest part C G, and again 5¼ inches at D H. A round should be turned of the same material to fit the hole, and should be 6½ inches in length. The other round must be of the same size and 8½ inches long. One end of each round can now be fastened into one side piece by a hickory peg ⅛ of an inch in diameter; the other side is fastened in the same manner, but the pegs on this side must be fitted so that they may be taken out to enable the net to be folded for transportation.

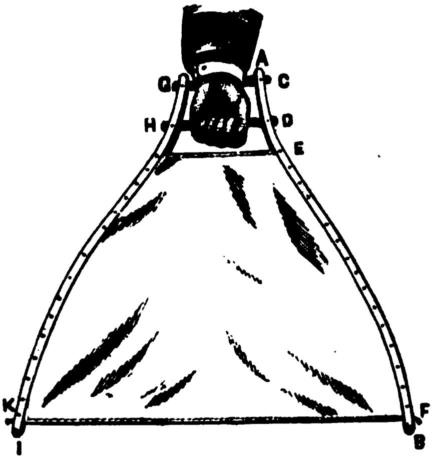


Fig. 3.

Fig. 4.

Now that the frame work is constructed, each side must be ripped centrally with a saw for 29 inches, commencing at the point B and extending to E. Through this slit a piece of unbleached domestic cloth must be drawn, a hem ¾ of an inch wide having previously been made across the ends at the points E and F. Fourteen screws are now inserted into each blade two inches apart which will hold the sheeting firmly and form the apron. The outside edges can now be cut closely to the frame work with a sharp knife. Previous to this operation a stout twine should be passed through the hem at the points F, K, and a knot tied at each end, but the twine should be an inch or two shorter than the apron, which will cause it to sag and better hold its contents. Where the twine passes through each side piece a gimlet hole ⅛ of an inch in diameter must be made to accommodate the twine.

The drawing is introduced not only to assist in constructing the net, but to represent the manner of handling it when collecting. Fig. 4 represents the net folded for transportation.

OBITUARY NOTICES.

Death has of late been making serious inroads among the ranks of our fellow-labourers in the Entomological field. An old veteran among American Naturalists, Dr. J. P. Kirtland, of Cleveland, Ohio, has passed away, while recent advices from across the Atlantic announce the deaths of Mr. Andrew Murray and Mr. T. V. Wollaston. Most of the details given in reference to the lives of the two latter are condensed from memoirs which have just appeared in *The Entomologist*, of London, England.

DR. JARED P. KIRTLAND

was born at Wallingford, Conn., on the 10th of November, 1793. His youthful studies were pursued at Wallingford and Cheshire Academies, and being a bright, active boy and an earnest student, he soon made rapid and substantial progress in the classics as well as in English studies. As a boy he was enthusiastic in the study of natural objects; he knew the habits of almost every animal and bird that frequented his youthful haunts, and at twelve years of age was engaged in practical experiments in the cultivation of silk worms. About the same time he began the study of Botany, and soon applied his knowledge to a series of valuable experiments in the crossing of fruit trees with the view of improving the quality of fruits. His success in this department is well known to all intelligent cultivators of fruits in America, his hybrid cherries having won for him a fame which time can never obliterate. His grandfather was a physician in Connecticut, and at his death his promising nephew, now eighteen years of age, inherited his grandfather's medical library and a sufficient legacy to enable him to acquire a medical education. He had made arrangements to pursue his studies in Edinburgh, when the war with Great Britain prevented him. About this time the medical department of Yale University was opened, and young Kirtland was the first student on its matriculation roll. Subsequently he graduated at the University of Pennsylvania, and in 1815 returned to his native place, where he practised medicine for two years and a half, devoting all his leisure moments to the study of natural science, for which he had developed a passion which influenced all his after life. He next removed to Durham, Conn., where he enjoyed an extensive practice for several years, when the death of his wife and child again unsettled him, and he removed to Poland, Conn. Five years later he was elected to the Legislature, where he served three terms, after which he was called to fill the chair of Theory and Practice of Medicine in the Ohio Medical College at Cincinnati, which he did with distinguished ability for five years, when the duties becoming irksome to him, he resigned the position.

When in 1848 the first Geological Survey of Ohio was organized, Dr. Kirtland was appointed to superintend the natural history department, and in due time presented a series of reports which attracted general attention. He laboured diligently among the Fishes, Birds, Mollusks, Reptiles and Insects of Ohio, sketching many of them with his own pencil and describing them with an enthusiastic fidelity. During his researches he collected a large and valuable cabinet of specimens with the design of forming a State Collection, but Ohio refused the substantial aid which this enterprise required, and as his collections had been made largely at his own expense, he retained possession of them, and they were ultimately donated to the Cleveland Society of Natural Sciences, where they are now treasured as a priceless heritage.

In 1837 Dr. Kirtland had purchased a choice fruit farm five miles west of Cleveland, and had there settled, as it proved, for the remainder of his busy life. Four years after this he was appointed a Professor in the Medical Department of the Western Reserve College, in Cleveland, a position he filled with honour for twenty-one years. In 1861 Williams College conferred upon him the degree of LL.D., in recognition of his services, and many learned societies during his lifetime delighted to do him honour. Among his Entomological papers, that which perhaps attracted most attention was his Notes on the Diurnal Lepidoptera of Western Ohio.

During the summer of 1872 it was our privilege to visit this veteran naturalist. We found him enjoying his quiet retirement among his flowers, fruits and insects, actively interested in everything that was going on about him. He gave us a most cordial welcome, and we spent a delighful afternoon together scanning his botanic and insect treasures.

Although nearly 80 years of age, he retained all his faculties in apparent perfection, his eyesight being so well preserved that he could read ordinary print with the greatest ease. He died after a short illness at his home, on the 11th day of December, 1877, at the ripe age of 84 yeas. He was among the most genial and winning of men, with heart warm and steadfast. His temperate, well-ordered life preserved him in the full vigour of manhood far beyond the years at which men ordinarily grow old. He had no dissipation but hard work, no extravagance but lavish generosity to his friends and overflowing charity for the poor. In his seventieth yeai of patient labour he wrote as his motto over his desk: "Time is money; I have none of either to spare." Thus this tireless man of science laboured to the end, laying down the work he loved so well after fourscore and four years of labour and usefulness, only at the call of the Master.

MR. ANDREW MURRAY, F. L. S.

This accomplished naturalist died at his residence, 67 Bedford Gardens, Kensington, on the 10th of January last. Mr. Murray was the eldest son of Wm. Murray, Esq., and was born in Edinburgh on the 19th of February, 1812, where he resided until 1860. In his early years he manifested a fondness for natural science which strengthened as he matured. He was educated for the law, and subsequently devoted some attention to the study of medicine. During the last few years of his life in Edinburgh he laboured hard in the interests of science; in 1858 he was elected President of both the Botanical Society and Physical Society, and just previous to his removal to London he contributed an elaborate paper to the Royal Society of Edinburgh, on the "Pediculi Infesting the Various Races of Man." In 1860 Mr. Murray came to London, and was appointed Assistant-Secretary to the Royal Horticultural Society, and from this time he devoted himself to his work as a scientific Botanist and Entomologist, becoming celebrated in the former as the monographer of the *Coniferæ*, and in the latter as the monographer of the *Nitidulidæ*. From 1852 to 1863 he published thirty-eight separate papers. 1866 he published his well-known work on the "Geographical Distribution of Mammals," in which he bestows especial attention on the habitat during geological as well as glacial and present epochs, with copious synonymic lists, including locality past and present, geographical classification and coloured maps of distribution, showing the result of his own careful research. In 1869 he accompanied Sir Joseph Hooker to the Botanical Congress of St. Petersburgh, as one of the representatives of British Science, his services there being complimentarily acknowledged by the presentation by the Emperor Alexander of a malachite table of great beauty. In 1871 he was entrusted with the superintendence of the arrangements connected with the British contributions to the International Exhibition of Moscow of the following year. He was Secretary to the Oregon Conifer Collection Committee, and in 1873 undertook an expedition to Salt Lake and California, with various scientific objects. On his return from the West he visited Canada, and spent a few days with some relatives in London, Ont., during which time we were happy in making his acquaintance and of forming with him a warm friendship which only terminated with his life. During his short sojourn in Utah he contracted an illness which greatly increased in severity, and, indeed, almost prostrated him on his return to Europe. Subsequently he rallied and for several years enjoyed moderate health. In the course of last season further indisposition followed, and he gradually sank, but so assiduously occupied with his labour of scientific usefulness to his latest days, that few were prepared to hear of their close.

But it is with Andrew Murray as an Entomologist that we are most deeply interested. In early life he aided his relative, John Murray (Lord High Advocate,) in his wish to provide some practically useful reading for village schools by writing the little pamphlet, "The Skipjack, or Wire-worm and the Slug," which, though published without his knowledge, may be looked upon as his first contribution to Economic Entomology. He contributed many papers on Entomology to various scientific societies and publications, both home and foreign, but his great work was done in the last ten years of his life, which he devoted to illustrating the study of insects in its natural and practical bearings. It was in 1868 that the charge of receiving and arranging a government collection of Economic Entomology was placed in his hands officially, and from the first he devoted himself unceasingly to the task of making this as perfect as possible. Himself an accomplished draughtsman, and a patient worker and compiler, with a great love for the subject, he spared no pains in his work, whether in availing himself of scientific co-operation or in shaping the aid placed at his service by those less gifted than himself in the details of field observation, and of museum illustration by coloured drawings or fac-simile modelling. This collection is already a nucleus of a very valuable, popular and illustrated history of insect friends and insect foes, the practical value of which is already appreciated and bearing good fruit for public benefit. On this collection, of which one hundred and fifty cases are more or less complete, Mr. Murray was working up to his latest days, leaving a large collection of oak-galls and illustrative drawings still in progress of arrangement. To assist in the circulation of information a series of guides to the collection were projected. These were to take the form of popular hand books to Entomology, and were to be prepared by Mr. Murray and published under government supervision. Of the eight intended volumes only one has appeared; this treats of the Aptera or wingless species, and was noticed in the *Canadian Entomologist* for July, 1877. In the midst of his busy labours he was called away. We have lost in him a man of varied accomplishments, a thorough, pains-taking Entomologist and a good Botanist. Those who knew him best will deeply feel his loss; not only will they miss the gifted naturalist, they will also grieve for the sudden removal of a friend so kind and true-hearted.

MR. T. V. WOLLASTON, M.A., F.L.S.

This talented Entomologist died on the 4th of January last, at his home in Teignmouth, Devonshire, at the age of 56, from disease of the lungs, with which he had been more or less afflicted for thirty years past. In early life Mr. Wollaston became well known for his valued researches into the Coleoptera of the Madeiran, Canarian and Cape Verd Archipelagos, which he personally explored. His valuable writings on the Coleopterous fauna of these islands, and especially his account of the insects of the Madeira group are well known to Entomologists in the "Insecta Maderiensia," published in 1854. Subsequently he published catalogues of the Coleoptera collected by him in these several groups of islands. His volume on the variation of species, dedicated to Mr. Chas. Darwin, and published in 1856, is well-known. His shorter papers, chiefly relating to Coleoptera, embodying the results of original research, contributed to English and foreign scientific journals, range over a period of more than thirty years. In the autumn of 1875, feeling it desirable to seek a warmer climate, he visited St. Helena, where he devoted himself assiduously to the study of the Coleoptera inhabiting the island of which work we have the record in his "Coleoptera Sanctæ Helenæ," lately published. This was Mr. Wollaston's last contribution to Entomological science, and is characteristic of its author in the finished elegance as well as clearness of its style. He returned to his home in the early summer of 1877, and thenceforward devoted himself to the task of arranging the valuable mass of information he had accumulated during his absence, and of which he leaves us the record in the work just referred to. He was a man of highly refined and accomplished mind, as well as of great scientific attainments, and will be much missed from the ranks of our leading naturalists, as well as by those whose progress he aided by his encouragement and counsel.

RECENT ENTOMOLOGICAL WORKS,

The following notices refer to some of the most valuable publications on Entomological and kindred subjects, which have appeared during the past year:—

Manual of the Apiary, by Prof. A. J. Cook, Lansing, Mich. Octavo pp. 286, with 110 illustrations; published by Thos. G. Newman & Son, Chicago.

We are indebted to our esteemed friend Cook for a copy of the second edition of this excellent work on Bee-culture, treating of the art in all its different branches in a clear, concise and interesting manner, showing throughout the author's thorough knowledge of the subject on which he writes. The work is divided into two parts, the first of which treats of the natural history of the honey-bee, the second on the Apiary, its care and management. It is well got up, and the illustrations are very good; we feel a pleasure in recommending it to all those interested in bee-culture. The fact that the first edition of 3,000 copies issued less than two years ago is exhausted, shows that the public have appreciated the author's efforts.

Entomological Contributions, No. iv., by J. A. Lintner.

We tender our sincere thanks to the author for an early copy of this fourth part of his admirable work, which appears in form similar to the previous issues, and occupies 144 pages.

It opens with a chapter on *Mermis acuminata*, a parasite on the larva of *Carpocapsa pomonella;* then an admirable account of the life history of the new Carpet Bug, *Anthrenus scrophulariæ*, with magnified illustrations of the insect in its several stages; following which are chapters on *Isosoma vitis*, the Lepidoptera of the Adirondack region of New York, Collections of Noctuidæ at Sugar at Schenectady, on some Lepidoptera common to the United States and Patagonia, on *Lycæna neglecta*, new species of Californian Butterflies, on some species of *Nisoniades;* descriptions of new species of *Cerura*, *Xylina*, *Hypocala*, *Acidalia*, *Cidaria*, besides a number of valuable notes on Lepidoptera illustrative of their life history and habits and geographical distribution. Every subject is treated in the author's usual thorough and systematic manner, and the work forms a valuable addition to our constantly increasing Entomological literature.

On the Tongue (Lingua) of some Hymenoptera, by V. T. Chambers. From the Journal of the Cincinnati Society of Natural History, April, 1878—8vo. pp. 13.

This paper is very interesting and instructive, and is intended as a reply to the questions —What do bees eat? and How do they eat it? An illustration of a transverse section of a bee's tongue accompanies the text.

Manuscript Notes from My Journal: Cotton and the principal insects, &c., frequenting or injuring the plant in the United States, by Townend Glover.

This excellent contribution to economic Entomology is published uniformly with the previous portions of "Manuscript Notes from My Journal," reviewed in earlier numbers of the *Can. Ent.*, that is, in quarto form, the text written and etched by the author, and afterwards printed from stone. The admirable plates, 22 in number, constitute in this instance the most considerable portion of the work and illustrate not only the insects which injure the cotton crop, but also certain forms of fungoid disease to which the plant is subject. A work so instructive and useful as this would be to those engaged in this important branch of Southern agriculture should be widely circulated. The small edition published has been got up at at the author's own expense, who has distributed the copies with the most liberal hand, free of any charge, among the libraries of the various scientific societies in the country; they are not, however, accessible to the general public. The untiring industry of this talented Entomologist is a marvel to all those who know of his work. It affords us great pleasure to find that he has so far recovered from his late severe illness as to enable him to resume thos Entomological studies in which he has so long taken a prominent part.

Descriptions of Noctuidæ, chiefly from California, by A. R. Grote. Extracted from the Bulletin of the United States Geological and Geographical Survey; large 8vo., pp. 18, containing descriptions of thirty-three new species, chiefly of *Argrotis* and *Hadena*.

New Tineina from Texas, Food Plants of Tineina, and Index to the Described Tineina of the U. S. and Canada, by V. T. Chambers; also from the Bulletin of the U. S. Survey; large 8vo. pp. 88. In this pamphlet there are forty-two new species described. A catalogue of the food plants of the Tinena of America, as far as they are known, is given, followed by a very complete and useful index embracing all the described American species.

Antigeny, or Sexual Dimorphism in Butterflies, by Samuel H. Scudder, 8vo. pp. 8, from the Proceedings of the American Academy of Arts and Sciences, vol. x.

The Insects of the Tertiary Beds at Quesnel, British Columbia, by Samuel H. Scudder, 8vo, pp. 15. From the Report of Progress, 1875-76, Geological Survey of Canada, containing descriptions of twenty species of fossil insects.

Additions to the Insect Fauna of the Tertiary Beds at Quesnel, British Columbia, by Samuel H. Scudder. From the Report of Progress, 1876-77, Geological Survey of Canada, 8vo., pp. 8, containing description of six species of fossil insects.

Fossil Coleoptera from the Rocky Mountain Territories, by Samuel H. Scudder.

Extracted from Bulletin of the Geological and Geographical Survey of the territories, Vol. ii., No. 1, 8vo., pp. 10, in which are described thirty-one species of fossil Coleoptera.

Notice of the Butterflies collected by Dr. Edward Palmer in the arid regions of Southern Utah and Northern Arizona, during the summer of 1877, by Samuel H. Scudder. From the Bulletin of the Survey, Vol. iv., No. 1, 8vo. pp. 5, containing references to forty-one species. We are very greatly indebted to the author for kindly sending us copies of the above valuable papers.

ENTOMOLOGICAL INDEX TO AGRICULTURAL REPORTS.

We have lately received through the kindness of the author, Professor Townend Glover, a most valuable publication entitled "Manuscript Notes from my Journal," being an Entomological index to the names, &c., of insects occuring in the annual agricultural reports published by the Department of Agriculture at Washington from 1854 to the present time, with a list of the vegetable and animal substances injured or destroyed by them.

This work is published in quarto form, and uniform in style with the previous works of the same author on Diptera, Hemiptera and Orthoptera, noticed in the earlier volumes of this journal. The first 77 pages are occupied with an alphabetical list of the names of insects referred to in the various reports, with brief explanatory references. Following this we have a list of insects to a greater or less degree beneficial by destroying noxious insects, a paragraph on other agencies referred to as useful in the destruction of insects, concluding with a list occupying 21 pages, also alphabetically arranged, of vegetable and animal substances injured or destroyed by insects.

The compilation of this work has been attended with much labour, and furnishes another evidence of the untiring industry of the author. It will prove an invaluable help to all who desire to consult the pages of these reports for information on Entomological subjects, and it is much to be regretted that the edition is not sufficiently large to make it make it accessible to all who may be interested in Entomology.

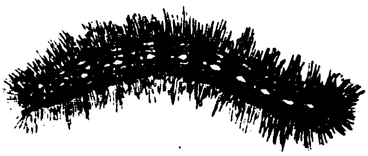
NOTES OF THE YEAR.

BY WM. SAUNDERS, LONDON, ONT.

THE FOREST TENT CATERPILLAR (*Clisiocampa sylvatica*).

These troublesome caterpillars (see Fig. 5) have again been very abundant in the western section of our Province, and early in June when nearly full grown they fed with such energy as to greatly damage the foliage of both fruit and forest trees, and became quite a terror to many. They travel with such rapidity from place to place that small trees entirely cleaned one day may be swarming with them the next, and where such trees have been newly planted and have made but small growth, a single day's neglect may result in the loss of the entire foliage which would greatly jeopardize, if not entirely destroy the life of such specimens. There are many pains-taking cultivators of both fruit and ornamental trees who are attentive to their plantations and make it a point to visit them regularly and to destroy all the caterpillars they can find, but who are greatly perplexed and discouraged by the repeated and continued invasions they are subject to from the hosts of these hungry larvæ which swarm in the neglected orchards of careless neighbours and also among the forest trees in the woods. To meet such cases the following simple and inexpensive remedy is suggested—it has been tried and found to work admirably: Take a roll of cotton batting, open it out and cut into strips about three inches wide and tie one of these strips with a piece of twine tightly about the middle, to any part of the trunk of the tree so as to entirely encircle it. In attempting to cross this barrier the multitude of minute horny hooks which fringe the margins of the base of the thick fleshy feet of the caterpillar become so entangled among the fibres of the cotton that further progress is almost impracticable, and the hungry worm wishing to ascend will be found walking disconsolately around and around the tree looking in vain for some way over the difficult pass, as they have no means of getting into a tree other than that of crawing up it. When once the trees are cleaned, this simple remedy is most effectual in keeping them so, and its use will result in a great saving of time and labour.

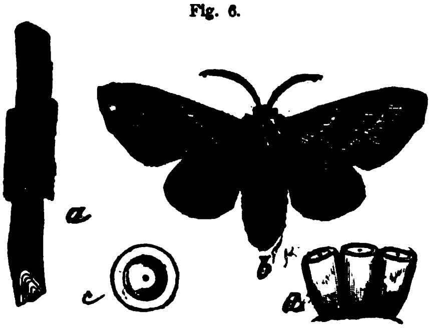
Fig. 5.



When large trees are swarming with the caterpillars—a very common occurrence in plentiful seasons—such should be visited every morning and the larvæ which are then congregated in masses on the trunks destroyed, which may be readily done by the vigourous use of a common broom.

A large number of these larvæ were destroyed this season by parasitic insects, many also by birds and by an unusual disease which for a time seemed epidemic among them. The survivors spun their silky cocoons in every available spot; between the leaves of trees and shrubs, in the corners of fences, the crevices in the rough bark of trees and other sheltered spots, and in a few days those which were free from parasites gave birth to the perfect moth, a female specimen of which is represented in Fig. 6 (after Riley), who speedily sets about accomplishing the end of her being by providing for a future generation. The well known egg cluster is shown at *a* (Fig. 6), the upper face of one of the eggs at *c* and the method of their arrangement at *d* in the same figure.

Fig. 6.



Some interesting observations have been made within the past year on these eggs including the discovery of a mite which devours many of them—these were communicated in a paper published in the *Canadian Entomologist* for February, 1878, from which we quote the following:

Some time during the month of October last, we were informed by Mr. B. Gott, nurseryman of Arkona, Ont., that he had observed on cutting into clusters of the eggs of *Clisiocampa* that the larvæ were at that time fully formed, a fact he had discovered by the use of a magnifying lens. It was our intention to take an early opportunity of verifying this statement by examination of the eggs under higher powers of the microscope, but delayed doing so for want of time. During the latter part of November Mr. A. Puddicombe, one of the members of our Society here, a careful observer and good microscopist, independently made the same discovery by cutting into clusters of these eggs with a sharp knife. He submitted the results of his observations at a meeting of the London Branch of the Entomological Society, held early in December, when the eggs were opened and examined under the microscope. We found the interior of the eggs perfectly dry, with a pearly lustre, the larvæ fully developed and only waiting warmth before making their escape. When the upper end of the egg was removed, the larvæ would frequently push their heads out and move them actively about, occasionally crawling almost or entirely out of the shell. Examinations have thus since been frequently made with eggs both of *C. sylvatica* and *C. Americana*. In several instances where the egg clusters have been kept in a warm room for a week or two, the larvæ, mistaking the warmth for that of spring, have eaten their way out of the shells, and finding no food, have died. These details, we think, are sufficient to establish the interesting fact that the larvæ of both these species mature early in the fall and hybernate inside the egg, waiting the warmth of spring before eating their way out.

Recently we devoted an evening to the microscopic examination of these egg clusters, having previously collected a number of them for this purpose. In many instances it was found that the glutinous coating which covers the clusters was imperfect, that a piece here and there had disappeared, leaving the eggs bare, and in some cases patches of the exposed eggs were empty. To ascertain, if possible, the cause of this, some of such affected clusters were cut into, when they were found to be colonized by mites. The outside gummy matter is of a sufficiently porous texture to afford abundant shelter to these little friends, who had evidently eaten into the eggs and devoured the young larvæ, and had also consumed the missing portions of the gummy covering. In the range of a single section of an egg mass some eggs would be found inhabited by the larvæ uninjured, while out of others would proceed several (in some cases as many as five) active little mites, who, when thus disturbed, would run in and out of their dwelling places, and keep up a peculiar drumming motion with their tiny antennæ. We found what where probably two different forms of the same species of mite, the one so small that four or five or more could find ample room and to spare within a single egg-shell, and these were very active and nearly transparent; the other much larger, of a pale red colour, with bright red eyes, sluggish in its movements and only one in each egg; indeed, one specimen nearly filled an egg. On the outside of some of the clusters were found some round pale red eggs, which we presumed were the eggs of these mites. From their structure the mites appeared to belong to the genus *Trombidium*.

We have submitted examples of these insects and egg clusters to Dr. H. Hagen, of Cambridge, Mass., and he has kindly and promptly examined them and confirmed the correctness of the views above advanced. Dr. Hagen says that he found the supposed mite eggs both empty and full of the small, active, white creatures, that these active specimens are doubtless the young of the larger red form, which latter is .04 inch long, and he is of opinion that it belongs to *Trombidium*. He further says: "In the whole European literature I have not been able to find anything about Acari eating eggs, so the fact seems new and is very important."

On almost every cluster we have examined we have found more or less of these mites, and if they are thus generally distributed over the whole district inhabited by the moths, they must prove a most efficient check to the undue multiplication of *Clisiocampa*. In No. 8 of our last volume we drew attention to the fact of the enormous abundance of the larvæ of *C. sylvatica* last year in many of the western portions of Ontario, and to the further fact that we had found a large number of the larvæ to be infested by parasites, both Dipterous and Hymenopterous. Notwithstanding this, large numbers matured and their egg clusters are numerously distributed over almost every forest and fruit tree. We have no evidence that birds devour many of them, hence we warmly welcome this new found friend, who has doubtless been silently working in our interest for many years past. In 1868 the larva of *sylvatica* was almost as abundant as it was last summer, while in 1869 very few were to be found. By the light of these observations it is easy to see that these destructive insects may be decimated by one or two methods, or by both ; in the first place, by the enormous increase of these mite enemies, or by the occurrence of a severe frost following a few warm days in spring, during which by the heat of the sun the larvæ have been incited to activity, and having left their snug winter quarters, have, while in a feeble and comparatively unprotected state, been destroyed by cold.

INSECTS AFFECTING THE VINES OF THE CUCUMBER, SQUASH AND MELON.

THE STRIPED CUCUMBER BEETLE (*Diabrotica vittata.*)

Probably during no season for many years past have the growers of the squash, melon and cucumber in the western part of the Province been so pestered with destructive insects as during the past year. The little striped cucumber beetle, fig. 7, seems to have been everywhere common and in many localities most destructive. This beetle feeds on the tender leaves of the young plants and damages the buds and young shoots of later growth, while its larva attacks the stems of the vines boring into them, and thus destroying the plants. It makes its appearance very early in the season as soon as the young plants appear, and sometimes it even penetrates the earth in search of the growing seeds. It is about a quarter of an inch long, of a bright yellow colour, with a black head and stripes of black on the wing covers, the underside of the abdomen and feet also are black. A few days later the female deposits her eggs near the roots of the vines which, in due course, hatch into tiny whitish worms, which burrow in the stems until full grown, when they are about one-third of an inch long and as thick as a good sized pin. Fig. 8 shows this larva magnified—1 showing the back, 2 a side view, the shorter lines to the left indicate the natural size. They attain maturity in about a month when they leave the plant and descend into the earth and form little cavities where they transform to chrysalids. They are less than a fifth of an inch in length, of a whitish colour ; the extremity of the abdomen ending in two rather long spines. In fig. 9 is shown a front and back view of the pupa enlarged. In the course of a fortnight the perfect beetle matures when it escapes from a state of inactivity to continue its work of destruction. There are usually not less than three broods in each year, the fall brood wintering in the chrysalis state.

Fig. 7.

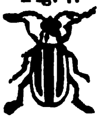


Fig. 8.

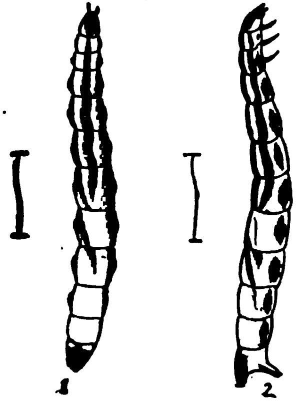
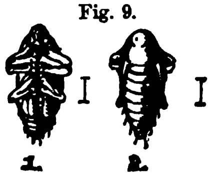


Fig. 9.

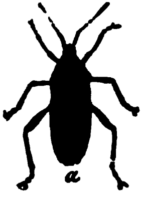


As a remedy, Paris-green has been recommended, mixed with flour, and sprinkled on the vines. A strong decoction of Smartweet is also spoken highly of by some, but the surest method of protection is to cover the vines while young with small wooden frames, covered with gauze on the top. This can be very cheaply done, and will entirely remedy the evil.

The Squash Bug (*Coreis tristis*).

This insect, fig. 10, has also been very abundant and proved a serious loss to many market-gardeners by its enormous increase, and the destructive effects of the presence of so many of its young on the vines of the squash and melon.

Fig. 10.



During the winter these bugs, full grown, remain in a torpid state, secluded in nooks and crevices, from whence they issue during the first warm days of spring. As soon as the vines of the squash have put forth a few leaves, the female bug begins to lay her eggs, which she does chiefly at night, depositing them in little patches on the underside; the eggs being glued to the surface. There, in a few days, they hatch into young bugs, which at once begin to suck the sap from the leaves by means of their proboscis, which is thrust into the leaf for this purpose. The young are short and plump, of a pale ash colour, and emit the same disagreeable odour as that which characterizes the parent. During their growth they shed their skins several times, gradually developing wings and retaining their activity throughout until they attain to the perfect winged state. At first they live together in little swarms on the underside of the leaves, which in consequence of the numerous punctures of the insects, and the quantity of sap imbibed by them, soon wither and appear as if scorched by fire. When the leaves have been exhausted in this way, they are deserted for fresh ones, and thus the work of destruction goes rapidly on.

The eggs are not all laid at one time, but like the Colorado potato beetle, the eggs and young may be found in their various stages of development throughout the summer.

The perfect bug measures six-tenths of an inch in length, is of a blackish colour above, and a dirty ochre-yellow beneath, while the sharp lateral edges of the abdomen which project beyond the closed wing covers are spotted with ochre-yellow. The thin overlapping portion of the wing cover is black, the wings transparent, but dusky at their tips.

To prevent the ravages of these insects they should be sought for early in the season and destroyed before they have an opportunity of laying their eggs. To this end they may be looked for about the last of June or beginning of July, when the dusky creatures may be found under the leaves on the ground, or on the stems of the vines close to the ground. If eggs have been laid they should be sought out and crushed. A short time spent in this way early in the season will save much disappointment afterwards.

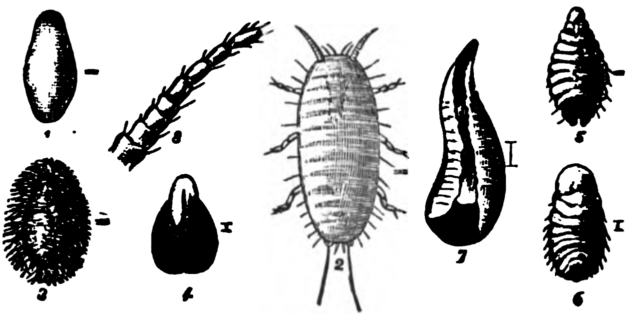
THE OYSTER-SHELL BARK LOUSE OF THE APPLE-TREE (*Aspidiotus conchiformis*).

Fg. 11.

The spread of this insect which is represented in figure 11, seems to depend very much on the nature of its surroundings. If it finds its way into an orchard where the soil is damp and the drainage imperfect, and the roots of the trees consequently unhealthy, the stunted and weakened growth which naturally results, is very favourable to the spread of this pest, and in such locations it is not uncommon to see branches of trees almost entirely covered with them, while other trees on adjacent higher ground will be almost or quite free from their attacks. Within the last two or three years we have several times found them attacking the branches of pear-trees, but in these instances their increase seems limited, and they do not thrive as on the apple. In Prof. Riley's fifth Annual Report, he states that they attack the currant, plum, pear, cherry and apricot. On the twigs of the apple, when allowed unmolested possession, they multiply in amazing numbers, and notwithstanding their extreme minuteness individually, yet by their constant and combined efforts in sucking the juices of the tree, they induce such a diseased state of the branches as is very discouraging to witness.

The name "Oyster-shell Bark Louse," has in this instance been suggested by the form of the scale which closely resembles that of an elongated oyster-shell. In colour it is ashen gray, much like the bark to which it is attached. This scale is formed by the mother-insect from exudations from her body during the summer, and about the end of August or beginning of September there will be found a quantity of very minute eggs beneath each scale. Having completed her work, the parent dies, but the eggs remain under the scale all through the winter until the following spring. Early in June, but sometimes, if the season is backward, a little later, the eggs hatch and produce

Fig. 12.

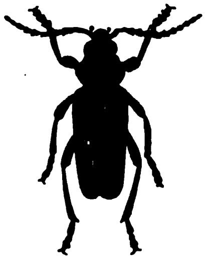


a number of very small plant lice (fig. 12),—2, which during the first hot day following, leave the enclosure they have so long occupied and scatter over the branches of the tree, attaching themselves by preference to the succulent terminal twigs. For a few days they retain the power of moving about, but after they once attach themselves to any one spot and begin to suck the sap there, they never move again, but remain as stationary as if they were a part of the twig itself. After a time each one becomes covered with a white waxy secretion, that issues from the body in the form of very fine threads (3) and which gradually results in the formation of a scale, such as is shown in the figure.

Remedies.—As the scale is tough and not easily penetrated, it is evident that the insect is most easily destroyed during the short time that intervenes between the escape of the young insect and the formation of the new scale. At that period, a strong solution of soap in lye applied to the branches with a brush is very effectual. During the winter and early spring months, much good may be effected by scraping the infested limbs, and thus detaching the scales, after which paint the parts with a mixture made by boiling tobacco leaves in strong lye and afterwerds thickening it with soft soap to the consistence of paint. A coating of linseed oil has also been recommended. Several insects prey on these lice, a very small fly, a species of *chalcis*, feeds in the larval state on the eggs; mites also destroy them.

The Maple Tree Borer (*Clytus Speciosus.*)

Fig. 13.



This destructive insect (see fig. 13), briefly referred to by Mr Bethune in our last Report, is increasing rapidly, and in many places proving very destructive to our sugar-maple trees, particularly to such as are planted along our streets. Preventive measures should be resorted to very generally, and we would strongly recommend the practice of painting the bark of the trees late in June or early in July with soft soap, reduced with strong lye to the consistence of cream. If this application is made on a warm day it soon dries and is then not easily removed by rain. An alkaline coating of this sort is extremely objectionable to the insect, who will usually, when selecting trees on which to deposit her eggs, carefully avoid placing her progeny in the way of such pernicious compounds, and even if she should err in this respect, the probabilities are that the newly hatched larva would perish in the effort to eat through the bark thus coated.

In our Report for 1872 there is an excellent article on this insect, from which, for the benefit of such as may not have access to that document, we condense the following relating to the life history of this troublesome pest. The beetles may generally be seen reposing quietly on the trunks of the trees during the day time. They are more active at night, which period they select for their excursions in search of their mates. The beetle lays its eggs upon the trunk of the maple in the months of July and August.

The larvæ hatched from these eggs are long, whitish, fleshy grubs, with deeply marked transverse incisions on the body. Their legs, which are six in number, are only rudimentary, and are of no service in locomotion; it is by means of the alternate contraction and extension of the rings or segments of the body that these little creatures force their way through the wooden tunnels in which they live, and in order to further assist their progress, each segment is furnished with fleshy tubercles capable of protrusion, and which, being pressed against the sides of their retreats, enable them to thrust forward by degrees the other segments. As the grub has to feed upon very hard material, it is provided with strong horny jaws, and the head which is slightly bent downwards, is also covered with a strong horny skin. The grubs penetrate the bark, under which they lie dormant during the winter, and in the succeeding spring and summer they pierce further in, running long, winding galleries up and down the trunk. The larvæ probably remain more than one year in this condition, and then change into pupæ, in which state they are at first, whitish and very soft, but gradually harden and darken, until the time arrives when the beetle is perfectly matured, and forcing a passage through the outer bark, near which it has instinctively eaten its way whilst yet a grub, emerges into the open air.

Their attacks can easily be detected by the sawdust and exuviæ that they cast out of their burrows, and in the spring, whilst still near the surface, it is quite possible to kill them by means of a stout piece of wire, or the judicious use of a good sharp knife.

THE NEW CARPET BUG (*Anthenus scrophulariæ*).

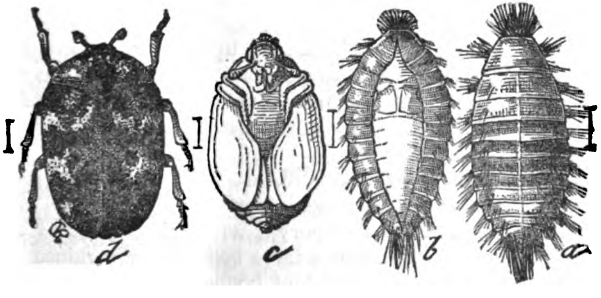
As this new pest, but lately introduced from Europe, is very probably in our midst, carrying quietly on its destructive work, we have thought it desirable to present our readers with as full details of its history and methods of working as possible, so that it may be recognized wherever it appears. Since we have had no opportunity of personal investigation in this instance, the following has been condensed from an excellent report on the insect by Prof. J. A. Lintner, of Albany, N.Y., in the fourth part of his entomological contributions.

During the summer of 1874 notices appeared in various newspapers of the ravages of a carpet bug, quite different in its appearance and in the character of its depredations from the well-known carpet moth, *Tinca tapetzella*. It was said to be found beneath the borders of carpets where nailed to the floor, eating in those portions numerous holes of an inch or more in diameter. Occasionally it located itself in the crevices left by the joinings of the floor, following which entire breadths of carpet would be cut across as by scissors. In several instances carpets had been destroyed, new ones as readily as older. The insect was described as a small ovate object, about one-eighth of an inch in length, thickly clothed with numerous short bristle-like hairs, and terminating in a pencil of these, forming a tail. It was exceedingly active in its motions and when disturbed in its concealment would glide away beneath the bare boards or some other convenient crevice so quickly as in most instances to elude capture. They were found only during the summer months.

In July, 1876, Prof. Lintner secured a number of the larvæ taken under the carpets of his own residence, in Schenectady, where their presence had not been suspected until search was made; they were fed upon pieces of carpet in order to rear them. In September they had evidently matured, and had assumed their quiescent pupal state within the skin of the larva, first rent by a split along the back for the escape of the perfect insect. In October the first perfect beetles emerged, when, being new to Mr. Lintner, they were sent to Dr. Le Conte, the distinguished Coleopterist, of Philadelphia, for determination. He returned answer that they were the *Anthernus scrophulariæ*—a species well known in Europe for its destructiveness, but now for the first time detected in this country.

The accompanying figure 14, kindly furnished by Prof. Lintner, was drawn by Prof. Riley, and represents this insect in three of its stages, viz.:—*a*, the larva; *c*, the pupa; and *d*, the imago or beetle. At *b* the skin of the larva, after the beetle has emerged from the fissure on the back, is shown. The figures are enlarged, the lines beside them representing the natural size.

Fig. 14.



The larva—the form in which it is usually found when pursuing its ravages beneath the carpets—measures at maturity about three sixteenths of an inch in length. A number of hairs radiate from its last segment in nearly a semi-circle, but are more thickly clustered in line with the body, forming a tail-like projection almost as long as the body. This terminal pencil of hairs is not shown in its full extent in the figure, doubtless taken from an immature individual. The entire length of the insect, including the pencil of hairs, is, in the largest specimens, nearly three-eighths of an inch. Measured across the body and the lateral hairs, its breadth just equals the length of the body. An ordinary magnifier will show the front part of the body, where no distinct head is to be seen, thickly set with short brown hairs, and a few longer ones. Similar short hairs clothe the body, somewhat longer on the sides, where they tend to form small tufts. Towards the hinder end may be seen on each side three longer tufts (thrice as long) projecting laterally, but these are not always visible, as the insect, by the aid of a peculiar muscular arrangement, has the power of folding them out of sight along its sides. The body has the appearance of being banded in two shades of brown, the darker band being the central portion of each ring, and the lighter the connecting portion of the rings known as the incisure. By turning it upon its back the six little legs, of which it makes such good use, can be seen, in vigorous efforts to regain its former position—its struggles while in this condition sometimes producing a series of jumps of about an eighth of an inch in length.

Having attained its full growth, it prepares for its pupal change without the construction of a cocoon or any other provision than merely seeking some convenient retreat. Here it remains in a quiet state, unaltered in external appearance, except somewhat contracted in length, until it has nearly completed its pupation, when the skin is rent along its back, and through the fissure the pupa is seen. A few weeks having passed, the pupal skin in its turn is split dorsally, and the brightly-coloured wing-covers of the beetle are disclosed. Still a few additional days of repose are required for its full development, when the now fully matured beetle crawls from its protective coverings of pupal case and larval skin, and appears in its perfect form.

The earliest beetles emerge in the month of October, and continue to make their appearance during the fall, winter and spring months. Soon after their appearance probably, they pair, and the females deposit their eggs for another brood of the carpet-eating larvæ.

The beetle is quite small—smaller than would be expected from the size of the larva—being only about one eighth of an inch long and one-twelfth broad. Its form is almost a perfect ellipse as seen from above; its back and under surface are quite rounded. When turned upon its back, it often for a few minutes counterfeits death, with its legs so closely folded to the surface as scarcely to be seen, and in this state the ordinary observer, might be at a loss to distinguish the lower from the upper side.

It is a beautifully marked little insect in its contrasting colours of white, black and scarlet, arranged as follows: the edge of each wing-cover where they meet on the back is bordered with red (forming a central red line), with three red projections from it outwardly, one on the middle of the back, and toward each end. Take a straight line and divide in four equal parts by three cross-lines, and we have nearly the position of these projections. At the extreme tip of the wing-covers is a widening of the bordering line, making almost a fourth projection from it. The first projection, near the head, is connected with a white spot, running upwardly on the middle of the front border of the wing-cover. On the outer border of the wing-covers are three white spots nearly opposite the red projections. The intermediate spaces are black. The segments of the body beneath are covered with pale red scales and the thoracic region with whitish scales.

It does not confine itself wholly to carpets, but it also infests and injures various articles of wearing apparel, hanging in closets or laid away in drawers. It will also destroy furs, leather and natural history objects.

A convenient place in which to discover the beetle is upon the windows of the infested rooms during the day, and they are found in the greatest abundance during the month of May. Should investigation show, that the beetle is drawn to the windows before the deposition of its eggs, their ready capture and destuction at this time will offer an easy method of preventing their increase.

Should this insect become generally common, it is difficult to conceive how, under such a visitation the comfort of carpets can still be indulged in within our homes. Even now when it has barely commenced its ravages, it is reported as having inflicted very serious pecuniary losses in several instances, where carpets have been entirely ruined, and such terror has its presence imparted, that not a few prudent housekeepers have already abandoned the customary nailing of their carpets to the floor, that frequent examinations may be made during the summer months for the discovery and destruction of the unwelcome guest.

It will unquestionably prove an exceedingly difficult pest to dislodge. The ordinary applications of camphor, pepper, tobacco, turpentine, carbolic acid, &c., are powerless against it. An effectual means of destruction, and preventive of new invasions is yet to be discovered. The free use of benzine has been recommended to saturate cotton with it, and fill the joinings of the floors and crevices beneath the base boards. This is to be done during the winter months, at which time the insect will be occupying these retreats, either in its perfect beetle form, or as eggs deposited for another brood. To either of these the direct application of benzine would be fatal, but on account of its extreme inflammability it would require to be used with great caution. Kerosene oil used in a similar manner would doubtless be equally efficient.

From the serious nature of its depredations, the secrecy with which it conducts them and the extreme difficulty with any known appliance of eradicating it—it becomes very important that it should from the outset be combatted by every means which may give promise of success.

BENEFICIAL INSECTS.

BY JOSEPH WILLIAMS, MONTREAL, QUEBEC.

THE LACEWING FLY—*Chrysopa.*

This beautiful insect belongs to the order Neuroptera, of which other well-known and representative members are the Dragon flies and the Ephemerids or May flies.

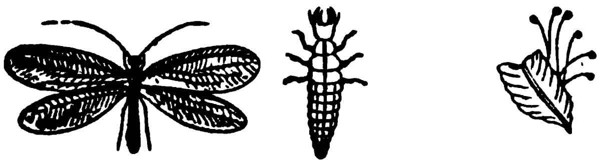


Fig. 15.

The accompanying figure gives a good idea of the form of this fly, as well as that of the eggs and larva.

The wings of the adult fly are large and broad, and pressed against the sides of the body when at rest; the antennæ are long, delicate, and many-jointed; and the head is small, with two very prominent and rounded eyes. Although the form may be accurately given, it is impossible, in an engraving, to do justice to the wonderful and delicate beauty of the insect, about which is not one particle either black or white. Its body, head and thorax are leaf green, and its wings are wide, thin, gauzy, and glossed with changing hues of green and pink, according to the angle at which the light falls on them.

The Rev. J. G. Wood, in his "Insects at Home," gives an excellent description of an English *Chrysopa,* which is so nearly identical with ours, that we may use his graphic words in this connection.

"The chief beauty of the insect lies, however, in its eyes, which, without the aid of a magnifying glass, look like two tiny beads of burnished gold, and have earned for the insect the popular name of the 'Golden Eye,' of which the Greek word *Chrysopa* is but a translation. But if the insect be placed under the microscope, and a brilliant light be directed on the eyes, a wonderful change takes place. They are very convex in form, and the hexagonal facets are marked with extreme boldness, considering the small size of the organ. They are so clearly defined, indeed, that even with a common pocket magnifier of low power they can be easily distinguished.

"Were the eye to be simple brown or even black it would be a beautiful object, in consequence of these hexagonal lenses, but over the whole surface of the compound eye plays a brilliant combination of colour. Every separate hexagon looks like a framework of burnished gold, changing with the shifting light into various hues of rich green and carmine. In fact the whole eye looks very much like a hemispherical brooch, entirely covered with emeralds and rubies.

"It is rather hard on the insect to expose it to this strong light, which is needed to bring out its beauties, for it is a lover of darkness, and only comes out after sunset, when it may be observed fluttering with apparently aimless flight in the air. But it is impossible to see the full splendour of this magnificent object without exposing the insect to some inconvenience. A dead specimen is useless, for the colour departs alike from the body and the eye. As to the pale green of the body, it is the most fugitive colour that an insect can possess, while the more gorgeous hues of the eye vanish soon after the life departs, and very little is left of their once magnificent beauty. Would that some method could be discovered of preserving the two fugitive tints of this lovely insect. There is a specimen now before me which has only been dead some forty-eight hours, and already the tender green of its body is fading, and the fiery splendour of its eyes is quenched. Lovely as is the insect to the eye, it can offend another sense most grievously, for it possesses a peculiarly evil odour, which attaches itself strongly to the finger that crushes it, and cannot be removed without many washings.

"The Lacewing fly is allied to the Ant-lions, of which we have no genuine representative in England. When in the larval state it is very predaceous, as is betokened by its large and curved mandibles. It feeds mostly on Aphides, of which it devours vast numbers, draining them of their juices, and then covering itself with the emptied bodies of its victims, so as to render itself scarcely distinguishable from the lichens among which it mostly lives. The neck of the larva is very flexible so that it can dart its head in any direction in order to seize its prey. It can eat two large aphides in one minute, and is so voracious that if two Lacewing larvæ meet each other they are sure to fight, and the conqueror is equally sure to eat the vanquished combatant. These larvæ are quick in their growth, and do not require much more than a fortnight before they pass into the pupal state, provided only that they can find an abundant supply of aphides on which to feed. When full fed, the larva spins a cocoon, in which it passes into the pupal and perfect stages. Like the Ant-lion, to which it is allied, it packs itself up in a wonderfully small compass, for the cocoon is only as large as a sweet pea, and very much in the same shape.

"The eggs of the Lacewing fly are quite as remarkable as the cocoon. They are generally deposited on leaves, but instead of being laid directly on the leaf, every egg is fastened to the end of a slender foot stalk about half an inch in length. The footstalk is formed from a viscous matter secreted by the female, and is delicately white and translucent. Mr. G. A. Butler, of the British Museum, told me that he has kept Lacewing flies, and often seen them lay their eggs. The end of the abdomen is first pressed against the leaf, and a tiny drop of the viscous matter deposited. The abdomen is then raised quickly, so as to draw out a thread, which becomes stiff and hard almost as soon as it comes in contact with the air. Then the insect pauses a little, and rapidly places an egg on the end of the thread, fixing it there with another tiny drop of the secretion. The eggs are always laid in groups. Some specimens in my own collection are laid along a lilac twig, and in all of them the remains of the viscous drops are apparent in the form of a partly conical footstalk, much resembling in shape and translucency the foot and stem of a wine-glass. The eggs themselves are pure white, and, when viewed through a microscope, have something of a papery aspect. They bear a curious resemblance to the capsules of certain mosses, and indeed have been described and figured in books as specimens of British moss."

The eggs of our Canadian Lacewing fly differ in colour from those mentioned in the foregoing description; they are of a pale green colour when newly deposited, but before hatching they become whitish, and each shows two or three faint dusky transverse bands. The larva leaves the egg in about a week from the time it is deposited, through an opening which it gnaws in the summit, and the shell remains empty, supported on its stalk, somewhat shrivelled, and of a white colour.

It is the larva of the Lacewing fly which renders such valuable service as to entitle it to a foremost place among our insect friends. This larva feeds on the aphides or plant-lice, which are so abundant on our fruit and forest trees, as well as on lesser plants.

In the Report of this Society for 1877 will be found an excellent article on these aphides or plant-lice, by W. Saunders, from which we learn "that in the case of the grain aphis, the wingless females become mothers when three days old, and thereafter produce four little ones every day, so that even in the short space of twenty days, the progeny of one specimen, if all were preserved from destruction, would number upwards of two millions." It is very evident, that were these creatures permitted to increase and multiply at their natural rate without material check, ere a few months had elapsed, every green thing on the face of the earth would be so covered with them as to cause general destruction. Now, one of the most effective enemies of these lice is the larva under consideration. Mr. Saunders says:—"the young larva begins at once to seek its food, and if it finds itself in the midst of a colony of plant lice, many of these speedily fall victims to its enormous appetite, but if not so favourably situated, a vigorous search is generally rewarded by the finding of a cluster of insects' eggs, or some newly hatched caterpillars, either of which will furnish our young traveller with a dainty meal. The larvæ of the different species vary somewhat in colour and ornamentation, but in most instances the ground colour is of a dull reddish brown, and there are whitish markings along the sides, and a dark central stripe. They all have long, narrow bodies, and are furnished with six rather long legs, and two long and slender, but powerful jaws, curved like a sickle, and down each side of the body is a row of tubercles, each tubercle being tipped with a cluster of spreading hairs or spines. Dr. Fitch mentions a novel use to which these hairs are put. He says that these voracious creatures often conceal themselves from view by placing the empty skins of the victims they have devoured, between their radiating bristles so that they adhere, and thus completely hide the insect from view. It is the skins of the woolly plant lice that they mostly employ for this purpose, and thus covered they resemble a little mass of white down adhering to the bark of the tree, presenting just such an appearance as does a little colony of woolly plant lice. By this device they are enabled to approach their victims without exciting their alarm, and to quietly devour them one by one."

The larva of one of the Lacewing flies is also an enemy of another pest of all orchards —the Curculio. In the "American Entomologist," vol. i., we find it stated that the larva of a *Chrysopa* was found inside a peach which had been badly bored by a Curculio, and the larva of the *Chrysopa* was actually preying on that of the Curculio, one half of which it had already sucked dry. The observer who reported this case states that he has since found over a hundred of these Lacewing larvæ engaged in the same good work.

In the autumn of 1846, Dr. Shimer observed the larvæ of a common species of Lacewing fly (*Chrysopa plorabunda*, Fitch) feeding voraciously on Chinch Bugs, which had swarmed over a field of fodder-corn, and were rapidly destroying it. The Lacewing flies were so abundant that this observer states that there were one or more of them for every stalk of the thickly sown corn, and every stroke of the cutter would raise three or four dozen of them, presenting quite an interesting spectacle as they staggered along in their awkward, unsteady flight. Dr. Shimer reared great numbers of the larvæ to the mature state by feeding them on Chinch Bugs, and his account of the operations of the larvæ when in captivity is so interesting we give it in full, from Dr. Shimer's Paper in *Proc. Ent. Soc.. Phil.*, IV., pp. 209, 210.

"I placed one of the larvæ in a vial after having captured it in the field in the very act of devouring Chinch Bugs of all sizes, and subsequently introduced into the vial a number of Chinch Bugs. They had hardly reached the bottom before it seized one of the largest ones, pierced it with its long jaws, held it almost motionless for about a minute while it was sucking the juices from the body of its victim, and then threw down the lifeless shell. In this way I saw it destroy in quick succession about a dozen bugs. Towards the last, as its appetite was becoming satiated, it spent five or more minutes sucking the juices from the body of one bug. After this bountiful repast it remained motionless for an hour or more, as if asleep. Never for a single moment during the feast did it pause in the work. When not in possession of a bug it was on the search for, or in pursuit of, others. It manifested much eagerness in the pursuit of its prey, yet not with a lion-like boldness, for on several occasions I observed a manifest timorousness, a halting in the attack, as if conscious of danger in its hunting expeditions, although there was none. Sometimes, when two or more bugs were approaching rapidly, it would shrink back from the attack, and, turning aside, go in pursuit of others. At length, awakening, it would renew the assault as before. On one occasion, when it was on the side of the vial, two inches up, with a large bug in its mouth, I jarred the vial, so that it fell to the bottom and rolled over and over, but, holding on to its prey, it regained its footing and mounted up to its former position. Occasionally the Chinch Bugs would hasten to escape when pursued, as if in some degree conscious of danger."

Here we may insert the opinion of Dr. Le Baron, State Entomologist for Illinois, U. S., in his second Annual Report, which is that it is only occasionally that the Lacewings are seen where Chinch Bugs abound, and they are nowhere numerous enough to make any perceptible impression on their multitudinous host.

The larvæ of the Apple Leaf Skeletonizer (*Pempelia Hammondi*, Riley), is also preyed upon by the larvæ of some Lacewing fly, and its round, white cocoon may often be found among the skeletonized leaves. (Riley's Fourth Annual Report for State Missouri, p. 45.)

These benefits are not all to be ascribed to the larvæ of one Lacewing fly, for there are several species (*Chrysopa oculata*, Say ; *C. plorabunda*, Fitch ; *C. rufilabris*, Burm., &c.)

which are concerned, but they are so much alike that it requires an experienced entomologist to distinguish them.

Tiger Beetles.

Order, *Coleoptera;* Family, *Cicindelidæ.*

Among the many common insects to be observed on a warm sunny day, none are more noticeable than our friends, the Tiger Beetles, both from their brilliant colouring and their rapid flight. These two characters are likely to induce the observer to attempt to capture them, but this is not always an easy matter, for these insects are very rapid in their movements, and, although they cannot fly long distances without frequently alighting, yet they manage by craft to escape their pursuer unless he has considerable patience. It is noticed that when one of these insects alights from a short flight, he does so with his head to his pursuer, whom he is careful always to keep in sight. They are most easily taken by a small net.

The Tiger Beetles frequent sandy banks and roads or other spots which are fully exposed to the light and warmth of the sun and free from vegetation. They delight in the full glare of the sun, but in cloudy weather disappear, to reappear with the sunshine. The Cicindelas have received the common name of Tiger Beetles on account of their ravages amongst other insects, pursuing and destroying incessantly all weaker creatures they encounter. But it is this very character which renders them worthy to be classed among our insect friends, as we shall see when we come to speak of their life.

We insert here life size illustrations of some of our Canadian species:—*Cicindela vulgaris*, Say; *C. purpurea*, Riv.; *C. hirticollis*, Say; *C. sex-guttata*, Fabr.; *C. generosa*, Dej.

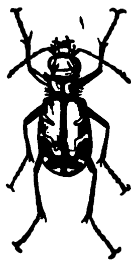


Fig. 16.

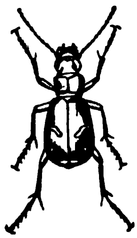


Fig. 17.

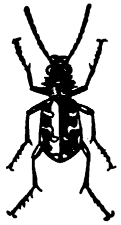


Fig. 18.

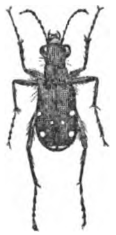


Fig. 19.

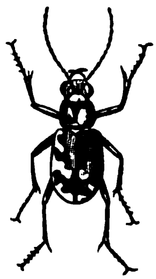


Fig. 20.

Cicindela vulgaris, Say (fig. 16), our most common species, is of a dull purplish colour above, and a beautiful bright brassy green underneath. On each of the elytra, or wing-covers, are three whitish irregular stripes. It is a little over half an inch in length and about a quarter of an inch in breadth, and has very long curved jaws of great power, and long slender legs.

C. purpurea, Riv., or the purple Tiger Beetle, is nearly as large as the preceding, and has markings as in fig. 17; its general colour is a beautiful metallic purple.

C. hirticollis, Say (fig. 18), is commonly called the hairy-necked Tiger Beetle, owing to the presence of a number of whitish hairs along the side of the middle segments of the body. It is a little smaller than *C. vulgaris*.

C. sex-guttata, Fabr. (fig. 19), is one of the most handsome of this family, its general colour being a very brilliant metallic green, and having six tiny white spots on its wing-covers.

C. generosa, Dej. (fig. 20), is a large and handsome species, occasionally found in Ontario, especially among the sand banks along the shores of Lake Huron.

In the life of a Tiger Beetle there are four stages:—The egg, the grub or larva, the pupa or chrysalis, and the imago or perfect insect; therefore it is said to undergo complete metamorphosis, in contra-distinction to some other insects which have not the same number of stages in their existence, and are consequently said to undergo incomplete metamorphosis.

The egg is deposited by the female in some favourable spot in the ground, where the larva, when born, will be able to secure food. The egg is hatched, and the larva comes forth a truly hideous-looking grub. (Fig. 21.) Compared with the rest of his body, his head is enormous, of a brownish colour, horny, and surmounted by two tremendous, curved jaws. This creature has three pairs of legs, and on the ninth segment or ring of its body are two large tubercles, each terminating in a pair of recurved hooks, and of a yellowish white colour. The larva is very voracious, and devours great numbers of insects, which it entraps in a very artful manner. It digs a hole in diameter about as large as a lead pencil, and said to be a foot or more in depth. To do this it hoists itself round, loads its broad head with as much dirt as it can carry, and deposits it around the mouth of the hole, forming a species of pit-fall, which sets itself in motion the moment anything endeavours to pass it. The grub clambers up near the top of this hole by means of the spines on his back together with his legs, and lies in wait for its victims. As soon as an unsuspecting insect ventures within reach, it is suddenly seized in the powerful jaws of our larva and carried underground, there to be devoured at leisure. It is diffiult to watch these proceedings, because these creatures are very mistrustful, and retire into their holes when alarmed. When the time arrives for the next step in its metamorphosis, the larva enlarges the bottom of the hole, stops up the entrance with earth, and awaits the change. It remains in the pupa state underground all winter, and emerges in the spring as the imago or perfect insect.

Fig. 21.

In this last or adult state, this insect is as ferocious as was the larva. It lives by continual warfare, subsisting on the bodies of weaker insects, of which it destroys great numbers. Their remarkable activity in running and their powerful jaws enable them to secure abundance of food, and thus they rid man of many insects which are, no doubt, very injurious to him, and as they are not known to injure anything that is of any advantage to us in any way, we feel no hesitation in including them among our Insect Friends, and bespeak for them the consideration of those disposed to kill them. Their bite is inoffensive, and not painful.

Carnivorous Ground Beetles.

Order, *Coleptera;* Family, *Carabidæ.*

The members of this family are not so nearly alike in appearances and habits as are those in the Cicindela family, therefore we will describe the characters of a few of the more common in detail, and mention their claims to the care and protection of all interested in the various branches of agriculture.

One of the most common species of this large family is *Calosoma calidum*, Fabr. (Fig. 22), which is commonly called the Fiery Ground Beetle, or the glowing Calosoma, owing to the presence on its wing-covers of six rows of spots of a glistening coppery colour. This beetleis very common in Canada, especially in the spring—May and June—when it may be found in the moist soil under stones and logs, which it prefers to hot and dry places. Its general colour is shining black, relieved by the six rows of copper coloured spots previously mentioned; it has three pairs of long and strong legs; and its eyes are large and very prominent, and enable the beetle to see its prey at a long distance. Its jaws are large and powerful.

This calosoma is a relentless enemy of other insects in two of its stages, for we find that both in its grub or larval state, as well as in its perfected state, it destroys great numbers of insect pests. The larva is, when full grown, a fat grub, slightly longer than the perfect insect, tapers gradually from the middle to each extremity, and is armed behind with two curved spines.

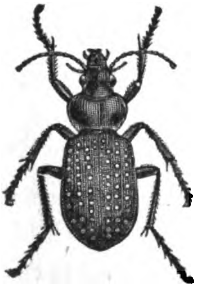


Fig. 22.

From Mr. Riley's First Report (Noxious, Beneficial and other Insects of the State of Missouri.) we learn that "this larva has very appropriately been called the cut-worm lion by

Dr. Shimer, of Mt. Carroll, Illinois, who gives the following account of its mode of transformation to the perfect beetle : 'The fat full grown larva of *Calosoma calidum* chooses a hard piece of ground, as a waggon road in the field, where it bores into to pass the pupa state. I have seen them many hours in boring a few inches. These fierce insects often wage terrible battles when they encounter each other, and they will eat each other as readily as cut-worms, as I found whenever I put more than one of them into my collecting box. He that would breed these insects to the perfect state must pack the dirt in his breeding box as hard as a waggon road, or he will fail, as I always did before I saw their operations in the field. In using moderately compact earth, the larva digs it over and over, endeavouring to find a suitably dense place, works up the dirt into balls, until its feet are clogged up with earth and juices from its mouth, and it sinks exhausted and dies. In a few days after it enters the grounds, the beautiful spotted, perfect beetle appears, and, strangely, the smell of the beetle is peculiar, and entirely different from the larva.' This cut-worm lion has quite a formidable appearance and is exceedingly agile. It is flattened, of a black colour, with six legs upon the breast, and a pair of sharp hook-like jaws projecting in front of its head. It pursues the worms in their retreats under the ground, and seizes them wherever it comes in contact with them. Sometimes a young cut-worm lion will seize a worm twice as large as itself, and will cling with a bulldog tenacity to its prey, through all its throes, its writhings and twistings, till at last the worm succumbs, exhausted, and the victor bites two or three holes in its skin and proceeds to suck out its juices."

Riley considers this larva the most efficient insect destroyer of cut-worms that is known, and when we consider the great ravages of these latter, we should carefully protect and foster any and every means that may prove useful in lessening their evils.

It is also well known that the perfect insect feeds on the larvæ of the common potato beetle, *Doryphora decemlineata*, Say. Our fiery ground beetle also destroys large numbers of the canker-worm, *Anisopteryx vernata*, Peck, a much-dreaded pest which attacks the elm, cherry, apple, plum and other trees. Our friend, being very active, runs over the ground in search of the soft-bodied canker-worms, and will even mount upon trunks of trees for the same purpose.

Another very destructive enemy which is devoured by *Calosoma calidum* is the army-worm, that pest which plays such havoc with wheat and other cereals in many districts.

The beneficial effects of the presence of a few fiery-ground beetles among growing plants is so clearly recognized, that many will take pains to secure them and transport them to their gardens.

The next *Calosoma* we will consider is the rummaging ground beetle, *Calosoma scrutator*, Fab. (Fig. 23.) also called the beautiful-bodied searcher, and the green caterpillar-hunter.

This is the largest and handsomest member of the family, but the beauty and brilliancy of its colouring require to be seen to be appreciated. It is larger than the insect previously described, but of the same general outline. The head and thorax are of a deep purplish colour, the latter with a greenish coppery margin ; the wing covers are of a bright and shining green, with fine longitudinal lines and scattered punctures, and a broad, coppery red margin. The underside is deep shining green, varied with coppery markings. The legs are blackish brown, in some lights deep purple.

"This magnificent beetle is rather a rare insect in Canada, though found occasionally in most parts of Ontario. Collectors of insects can often find specimens in summer, after a southerly gale, on the outer shore of Toronto Island, which is a famous place for obtaining rare beetles that have been drowned in the lake and washed ashore by the waves." (Rev. C. J. S. Bethune in Annual Report of Entomol. Soc. of Ontario, 1872.)

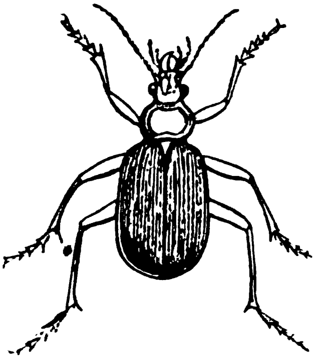


Fig. 23.

Among the insects preyed upon by this insect friend are the canker-worm, the army-worm, and the forest-tent caterpillar, *Clisiocampa sylvatica*, Harr., which latter is well known in Canada from its ravages during the past few years.

Harpalus caliginosus, Fabr. (fig. 24) is another member of the family under consideration, and is true to its family instincts. It is narrower in outline, than the two preceding insects, and is not so handsomely marked; it is of a dull black colour. This beetle is an enemy to the Colorado Potato Beetle and the army-worm.

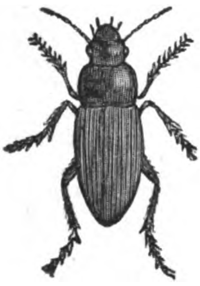


Fig. 24.

An allied species, *Harpalus Pennsylvanicus*, DeGeer, is more common than the last. In Fig. 25 we give an illustration of the perfect insect, and in Fig. 26, of the larva.

The larva is about an inch and a quarter in length, is of a shining brown-black colour above, and a dull-whitish beneath. According to Mr. Riley it is an efficient destroyer of the larva of the Plum Curculio, which it seeks in their underground hiding-place and mercilessly devours.

In the Western States this larva has been found feeding on the eggs of the Rocky Mountain Locust, *Caloptenus Spretus*, Thomas, and another *Harpalus* larva was found engaged in the same creditable labour.

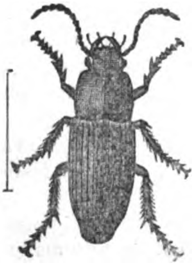


Fig. 25.

Another member of this family, the Elongate Ground Beetle, *Pasimachus elongatus*, *Lec*, is also one of the insect enemies of the Colorado Potato Beetle, also of the Rocky Mountain Locust, and of the Army Worm. This beetle is of rather elegant form, and is bright-black in colour, with a deep blue margin.

The last insect of the Carniverous Ground Beetles which we will mention specially, is a little Bombardier beetle: ***Brachinus** fumans, Linn.*, of which we give an illustration in Fig. 27.

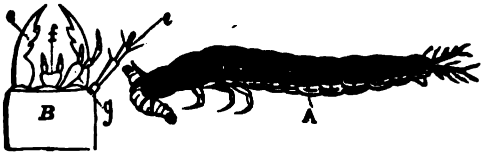


Fig. 26.

This insect with other members of the Brachinus family, have an extraordinary power of ejecting, from glands near the tail, an irritating fluid, which is doubtless a means of defence against its more powerful neighbours. A writer in the ***American Entomologist***, vol. 2, p. 30, thus relates his experience with one of these Bombardier beetles:—"Upon one occasion when we were collecting insects and—as often happens—saw at the same moment two rapidly running beetles, both of which we were desirous to capture, we thoughtlessly put one of the two, which happened to be a Bombardier, between our lips so as to hold him securely while we caught and disposed of the other one. Forthwith he fired away the customary discharge of blue smoke from his tail; and the next intant our lips felt as if a bottle of the strongest aquafortis had been emptied upon them. But we were not to be fooled thus. The more he blazed away the tighter we held him; and after a copious discharge of saliva from our mouth, the disagreeable sensation passed off in some five minutes, without any further unpleasant results."

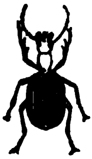


Fig. 27.

This ejection of fluid is accompanied by a crackling explosion and blue smoke or vapour in which the little artilleryman makes good his escape from ordinary insect enemies.

In Kansas, the *Brachinus Kansanus, Lec*, has been found attacking the larvæ of the ubiquitous Colorado Potato Beetle.

A great deal more might be added of the services rendered to the agriculturist and gardeners by various members of the *Carabidæ* family, but we think sufficient has been given to show that they are among the most valuable of our insect friends and worthy of protection.

The *Carabidæ* are the carnivorous land insects *par excellence*, while their great voracity, their powerful physique, and their great numbers, make them one of the most efficient means of keeping insect pests within bounds. The family is very large, fortunately, and is compared by Michelet to "an immense tribe of warriors, armed to the teeth, which, under their heavy cuirasses, have a wonderful activity, are a perfect rural constabulary, day and night, without holidays or repose, protecting our fields. They never touch the smallest thing. They are occupied entirely in arresting thieves, and they desire no salary but the body of the thief himself."

Lady Birds.

Order, *Coleoptera*, Family, *Coccinellidæ.*

Lady bird, lady-bird, fly away hóme
Your house is on fire and your children are burned.

These words are no doubt familiar to all our readers, old and young, for, as Mr. R. V. Rogers graphically says (*Canad. Entomol.* Vol. VI. No. 5) : " 'Of all the painted populace that live in fields, and live ambrosial lives,' there is scarcely a family better known than those which compose the last of all the tribe of Hard-shells, the Coccinellidæ. To the young and to the old, to the illiterate and to the scientist, they are equally familiar and equally interesting. Popular sympathy is extended towards them by the elders, because " they do much good in preventing the excessive multiplication of aphides, by the juveniles, because they are very pretty little things and tamely pitter-patter to and fro, and their supposed misfortunes affect deeply sensitive little hearts, while infantile accents lisp—'lady-bird, lady-bird, fly away home, your house is on fire and your children are burned.' "

We introduce here illustrations of some of the more common of our Canadian species.

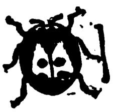


Fig. 28.

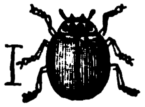


Fig. 29.

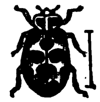


Fig. 30.

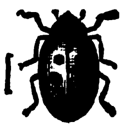


Fig. 31.

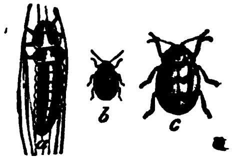


Fig. 32.

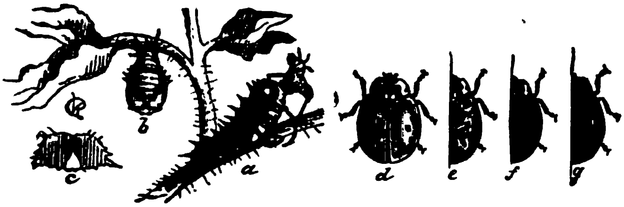


Fig. 33.

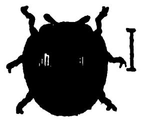


Fig. 34.

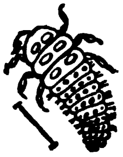


Fig. 35.

Fig. 28. Nine-dotted Coccinella *Coccinella novem-notata,* Herbst.).
Fig. 29. Plain Lady-Bird (*Coccinella munda*), Say.
Fig. 30. Spotted Lady Bird (*Hippodamia maculata*), *DeGeer.*
Fig. 31. Thirteen dotted Lady Bird (*Hippodamia* 13-*punctata, Linn.*).
Fig. 32. Convergent Lady Bird (*Hippodamia convergens,* Quer.).
Fig. 33. Fifteen spotted Mysia (*Mysia 15-punctata* Oliv.).
Fig. 34. (*Chilocorus bivulnerus,*) Mulsant.
Fig. 35. Larva of *Coccinella novem-notata,* Herbst.).

These will give a general idea of the appearance of these beetles, for they all have a strong family likeness, so much so, that entomologists are sometimes at a loss to discriminate between some species, which will not appear strange when we remember that there are over one thousand species known, of which only some thirty have as yet been taken in Canada.

The general shape of Lady Birds, when they are resting on a flat surface, may be compared to one-half a split pea—flat underneath, and convex in both directions above. As will be seen from the above illustrations, in some cases, the head of the insect scarcely projects beyond the circular outline of the body. Most of the Lady Birds are gaudy little creatures, being ornamented with red, white, yellow, black and orange colours, arranged in bands or in circular and semi-lunar spots, generally placed regularly on the two elytra or wing-covers. Their legs are very short, and the insect creeps slowly; when the beetle is alarmed it withdraws its legs and remains quiet for some time; if it is climbing when disturbed, it will close its legs under its body and allow itself to fall, but sometimes will open its wings and fly off rapidly. When laid hold of, these beetles have the curious property of causing a yellow, mucilaginous liquid, of a strong, pungent and disagreeable odour, to exude from the articulations of their abdomens, and this appears to be the only means of defence possessed by these little inoffensive beings. This fluid has been held by the ignorant to be a certain remedy for the toothache, but in as many other similar cures, the therapeutic value is entirely confined to the faith exhibited, and the greater the faith the greater the cure.

Lady Birds often occur in immense swarms, as in one instance, cited by Kirby and Spence, "the banks of the Humber were so thickly strewn with the common species, that it was difficult to walk without treading upon them." These swarms often alarmed the superstitious, who thought them the forerunners of some great evil.

The eggs of lady-birds are long, oval, and yellow, and are laid in patches, often in a group of plant-lice, which the larvæ, as soon as they are hatched, greedily devour. Here we have an excellent example of instinct in the mother lady-bird, for the plant-lice are the natural food of our little insect friends.

Packard (Guide to Study of Common Insects, p, 511) thus describes the changes which takes place in the common two-spotted coccinella. "The eggs of the common two-spotted coccinella *C. bipunctata*, Linn., are laid in May, on the bark of trees, and those of another brood are laid in June, and hatched July 1st. They are oval, cylindrical, orange-yellow, and are attached in a bunch of about twenty-five, by one end to the bark. They hatch out when the leaves and their natural article of diet, the aphis, appear, and may be found running about over the the leaves of various garden shrubs and trees. The body is black with flattened tubercules spinulated above; on each side of the first abdominal segment is a yellowish spot, and there is a broad yellowish spot in the middle of the fourth segment, and one on each side. On June 28th we found several fully grown larvæ a quarter of an inch long, transforming into pupæ, with a freshly transformed beetle. The larva begins the operation by attaching very firmly, with a sort of silky gum, its tail to the leaf, the point of attachment not being the extreme tip, but just before it, where the tip of the abdomen of the pupa is situated, Meanwhile the body contracts in length and widens, the head is bent upon the breast, and in about twenty-four hours the skin splits open and discloses the pupa. The body of the pupa is black, the head is also black, and the prothorax is yellowish black and pink, with a black dot on each side, and a smaller black dot on each edge; the meso-thorax, wing-covers, scutellum and legs are shining black. The abdominal rings are pale flesh-coloured, with two rows of large black spots on each side, the spots being transverse; the terga of the fourth to the seventh segments are separated, the body being arched and leaving a deep furrow between. The beetle is orange-yellow, with a black head and thorax; the side of the prothorax is whitish, with a central diamond-shaped white spot, and behind it a much larger whitish spot. The beetle derives its specific name from the two black dots on the elytra. It hybernates, and might be used to clear house plants of plant-lice."

Referring to the illustrations at the beginning of this article, we may give the following short description of the various insects there figured, in order to render the illustrations more valuable:—

C. novem-notata is a nearly round insect, of a brick-red colour, with nine black spots on the wing covers.

C. munda may be easily distingushed from most of the other species, as it is of a brick-red colour, and has no markings on its wing covers.

Hippodamia maculata is a pinkish coloured beetle, with twelve large black spots.

H. 13-punctata is larger than the previous, and has thirteen black spots on a brick-red ground.

H. convergens is of a deep orange-red colour marked with black and white. Its larva (Fig. 32*a*) is blue, orange and black in colour, *b* shows the pupa or chrysalis suspended by the tail, and *c* the perfect beetle.

Mysia 15-punctata varies much in colour from a light grey to a deep chestnut brown, so that an unskilled observer would scarcely imagine that the four varieties in Fig. 33 were one and the same species. It has fifteen black spots on its brownish wing-covers.

Chilocorus bivulnerus is commonly called the twice stabbed lady-bird ; it is a highly polished black beetle, with two yellow spots. It is very obese.

Perhaps the most simple plan by which to enumerate the benefits arising from the existence of the lady-birds, will be to take *seriatim* the insects upon which they are known to feed : we will begin first with the

Aphidæ or plant-lice.—As is well known, many of our fruit trees and flowering plants are sometimes seriously injured by the work of the minute and innumerable plant-lice. The hop is subject to the attacks of the hop aphis (*Aphis humuli*, Curtis) and so great is the ruin caused, that Kirby and Spence state, in speaking of its ravages in England, "The hod grower is wholly at the mercy of these insects ; they are the barometer that indicates the rise and fall of his wealth, as well as of a very important branch of the revenue—the difference in the amount of duty on hops being often as much as £200,000 per annum, more or less, in proportion as the fly prevails or the contrary." In this country, fortunately, the ravages of this Aphis do not appear to have been as serious, although many an acre of fine healthy hop plants have been scoured by these creatures, causing entire loss.

Wheat, oats and other grain are frequently attacked by the grain aphis (*Aphis avense* Fabr.) an insect pest introduced into this country from Europe. The cherry-tree suffers from the *Aphis cerasi ;* the apple-tree from the *Aphis mali* on its tender leaves, and the *Eriosoma pyri* at its roots ; the currant bushes from *Aphis ribis ;* the cabbage from *Aphis brassica.* Besides these, and many other plants living out of doors, conservatory and hot-house plants do not escape the ravages of plant-lice.

It is the enormous rate of increase of these tiny creatures that surprises all who have had the care of plants ; and which renders all artificial remedies of little value except in narrow limits. We may have an idea of the enormous fecundity of these creatures from a calculation by Curtis, a celebrated English entomologist, who computed that from one egg only, there would be produced in seven generations, taking thirty as the average of each brood, the enormous number of seven hundred and twenty-nine millions, so that were all permitted to live, everything on the face of the earth would in a short time be covered with them.

Before this inconceivable increase artificial remedies would avail little, but fortunately the natural enemies of the aphidæ are legion, and among the most valuable of these are our pretty little Lady Birds. As we have seen before, the female Lady Bird places its eggs among the plant-lice, and the larvæ as they grow live upon them, devouring great numbers.

Dr. Fitch relates an amusing story of a mistake which was made by one of his neighbours, whose rose-bushes were grievously invested by plant-lice. He complained, we are informed, to the doctor, that although he took the greatest pains to go over the infested bushes every morning and destroy all the "old ones," yet that his bushes were ten times as badly injured by plant-lice as those of his neighbours, who took no pains at all to war upon the enemy. On examination it turned out, that the worthy gentleman had occupied every morning in killing off all the Lady Bird larvæ that he could find, supposing that these were the mothers of the plant-lice, and that he should thus nip the evil in the bud. In other words, he had fired into the ranks of his best friends, and allowed his enemies to march where they would, and increase and multiply at discretion.

We hope none of our readers may make the same mistake, but will cherish the presence of these little beetles among their favourite plants.

The next insect pest preyed upon by our friends is that terrible scourge of grain growers,

The Chinch Bug.—This voracious creature, known to entomologists as *Micropus leucopterus*, Say, is perhaps more dreaded by grain-growers throughout America than any other of the insect enemies he has to fight against, because its work of destruction is complete. From Riley's Second Annual Report for Missouri we learn that four species of Lady Birds are known to feed on Chinch Bugs, these four are *Coccinella munda, Hippodamia maculata,* and two species of the genus *Scymnus.* In this report Dr. Shimer records that in a particular field of corn, which had been sown thick for fodder, and which was swarming with Chinch Bugs, he found that the spotted Lady Bird (*C. munda*) could be counted by hundreds upon every square yard of ground after shaking the corn, but the Chinch Bugs were so numerous that these hosts of enemies made very little perceptible impression among them. Notwithstanding the apparently small amount of good done in some cases, it is the duty of the intelligent farmer and gardiner to cultivate assiduously the acquaintance of all his insect friends, for although their individual efforts may be feeble, yet combined they no doubt maintain a powerful check on insect enemies.

Another common insect which is subject to attacks of Lady Birds is the well-known and universal *Colorado Potato Beetle.* Five species of our friends are known to devour this beetle—the spotted, the nine-spotted, the thirteen-spotted, the convergent, and the icy, Lady Birds; the latter, *Hippodamia glacialis*, Fabr., is closely allied to the Convergent Lady Bird, and is found far north, and may be taken under the ice and snow. The larvæ of these are equally as voracious as the perfect beetles, but the larva of the *H. convergens* is a perfect cannibal, for when there is a deficiency of other good food, he has no hesitation in devouring the helpless pupæ of his own kind.

The Grape Phylloxera, *Phylloxera vastatrix*, Planchon, has been found to be attacked by several species of the genera *Coccinella* and *Scymnus*, whose young, thickly covered with white and evenly shorn tufts of a cottony secretion, are frequently found at their good work within the galls. The last pest we will now mention is

The Pine-Leaf Scale Insect, *Mytilaspis pinifoliæ*, Fitch, a bark-louse which injures many of the pine trees, as the red, the white, the yellow, the Pyrenian, the Scotch and others. "The twice-stabbed Lady Bird may frequently be found crawling over the scale-infested trees, and is most efficient in checking the increase of the Coccids. Both the beetle and its gray and prickly larva feast upon the lice, and require great numbers of such minute animals to appease their appetites. I have often colonized a dozen or more larvæ on to a badly affected young tree, and the rapidity with which they clear such a tree is both interesting and satisfactory. Still another insect of this family, namely, the Painted Lady Bird (*Coccinella picta*, Randall), I have discovered preying on our Pine-leaf Scale. (See Riley's Fifth Annual Report).

AN OUTLINE SKETCH OF THE CANADIAN BUPRESTIDÆ.

BY JAMES FLETCHER, OTTAWA.

Of all the enemies against which man has to contend, there are none, perhaps, which are so hard to combat, nor which deserve more attention, than those belonging to the insect world.

These tiny atoms, apparently so insignificant, in some instances so small, as to need the closest search, or even a microscope, to discover, beset him in every direction, and, if ignored, will cut, pierce, and, in some cases, utterly destroy whatever his labour produces. Not many years ago Entomology was one of the most neglected Sciences, and only considered worthy of the attention of simple people and children, as describing pretty things likely to amuse them; to such an extent was this carried, that as late as the last century a lady of high rank in France was burned as a witch, the only evidence against her being that she was seen to collect and preserve insects. Even at the present day, both in England and Canada, there is much deplorable ignorance of "La belle Science" among the very people to whom, more than any one else, a knowledge of it is of the first importance. I have frequently been greeted with smiles of amusement (which have had a good strong admixture of pity in them) from farmers and countrymen, when asking for permission to collect on their grounds, the general tenor of their answers being, "Oh, yes, I suppose you won't do much harm;" and I have always been under a very decided impression that they looked down upon me as a poor innoxious creature that *could* do no harm. Many a quiet chuckle have I had in the deepest recesses of my sleeve, and many a quiet ramble, too, have I enjoyed, by this means perfectly immuned from all interruption by game-keepers or farm labourers, who regard the Entomologist (*Angl:* "Fly-catcher," *Amer:* "Bug-catcher,") much in the same light that they view the rooks that pick up the worms after the ploughman. These good simple fellows (not that I wish in the least to retaliate) will sometimes endeavour to encourage you, and even assist in collecting insects, which in the case of Coleoptera, are occasionally good specimens; but that is the exception, and by no means the general rule, especially with Lepidoptera. On one occasion during the past summer, I was hailed by a gardener who informed me that he had a "bug" for me, and who, after fumbling in his trousers' pocket for a short time, produced a tin tobacco-box, and then, from beneath some very black, damp-looking tobacco, disentombed what was once a female *Attacus Polyphemus.* "There it is," he said, looking at it with much admiration, "it is rather crumpled (it had about half of all its wings cut off by the tin box), but I daresay you will be able to straighten it out again."

Thanks to the efforts of Messrs Harris, Fitch, and Riley, in the United States; Curtis and Wood, in England; and Saunders, Provancher, and Bethune, in Canada, amongst many others, to popularize Economic Entomology, it has made great strides of late years; and the exceedingly low figure at which their works may be obtained, brings it within the power of every one to possess himself of information which will enable him to fight against most of the insect pests, likely to occur to any extent, in our Dominion. I herewith contribute my mite to the cause, in the shape of an outline sketch of the family Buprestidæ. The large number of species included even in our Canadian list of these beetles, will not allow me to more than describe the leading characteristics of the different genera with some of the more interesting species. My object is to give such an idea of the general appearance and habits of these insects in their different stages as will enable the horticulturist and farmer to distinguish them, and check their ravages. Besides my own observations, I have embodied what I considered most interesting from the works of the best authors on the subject, and as some of these are difficult to obtain, I have repeated some facts which are probably known to most Entomologists, but possibly are not to the greater number of those who will receive our Annual Report. The classification I have followed is that of Lacordaire, as adopted by Dr. Leconte in his Classification of the Coleoptera of North America, published in 1863. I have, too, used to a great extent the words of the latter, in the scientific descriptions at the end of this paper.

The Buprestidæ, form the first section of that division of Serricorn Coleoptera, known by the name of Sternoxi, or Sharpbreasted, and have the under part of the thorax (*Lat.* sternum—breast-bone) prolonged into a point.

The word "Buprestis" is an interesting one, and is one of the scarce instances in which the great naturalist, Linnæus, gave an inappropriate name; its literal meaning is "ox-burner," derived from two Greek words βοῦς, an ox, and πρήθω, I inflame. Amongst the ancients the names Buprestis, Vulprestis, Bustrepis, Bubestes, etc., were applied to a poisonous insect, which, when eaten by cattle as it lay hidden in the grass, it was averred, caused them to inflame, swell, and burst; indeed, so noxious was it considered that a special law was made against its use, in the Pandects of Budæus, which was to the effect that "whosoever should administer a Buprestis, with intent to kill, should be held guilty of a capital offence and condemned to die by the Cornelian Law." Geoffroy, adopting the opinion of Mouffet, considered the "Buprestis" of Pliny to be the "Carabus" of Linnæus; but Latreille, who published a memoir on the subject in 1812, considered it to be a Meloe, the species of which live among grass and low herbage, and, moreover, possess very strong blistering properties. Following this suggestion, and assisted by Belon, who discovered an insect on Mount Athos with the same properties and called by the inhabitants "Voupristi," Kirby & Spence seem to have correctly identified the insect of the ancients as a Mylabris. The present species, which are classed under the head "Buprestidæ," have nothing whatever in common with it except the name, and that they have wrongfully usurped.

The Buprestidæ form an immense family of gorgeously-coloured insects, containing many tribes, sub-tribes, groups, genera, and in all about 1,500 species. They are pretty generally scattered over the whole world, being, however, much more numerous in warm climates. In brightness of colour they by far surpass every other family of insects; in fact Dame Nature seems to have outdone herself in the adornment of these living gems, and to have used them as experiments to see what startling effects and contrasts she could produce. As a rule their surfaces are highly polished, having the appearance of burnished metal—gold, bronze, steel or copper, and seem to be glazed with some surface-colour, which changes as they are viewed from different angles. Green and crimson are the two prevailing hues; but there is hardly any imaginable shade that cannot be found amongst them, they are particularly remarkable for metallic tints. That peculiarly beautiful green known as "beetle-green" takes its name from the elytra of certain species, which are used in India and South America for the ornamentation of ladies' dresses, baskets, fans and other objects.

The sizes and shapes presented by the different genera of this family are no less remarkable and varied than the colours. The size varies from scarcely one line in length in *Aphanisticus puvillus* to nearly three inches in *Catoxantha gigantea*, the Goliath of his race. The shape, which, on account of the shortness of the legs, is not very graceful, embraces the following forms, viz.:—Cylindrical, conical, oval, oblong, flat, some almost triangular, and others even linear; in all the Elytra taper more or less abruptly to a point.

Westwood has mentioned some interesting particulars with reference to their geographical distribution, *ut seq*:—" At the Cape of Good Hope is found an extensive group, having the elytra ornamented with tufts of yellow or white hairs. The conical species abound on the shores of the Mediterranean, Caspian and Black Seas, and at the Cape. Madagascar produces an extraordinary group, having the body flattened, and of a nearly rounded form; whilst in New Holland the genus Polychroma and several others have been exclusively found."

and others even linear; and in all, the elytra taper more or less abruptly to a point.

As instances of some of the most striking examples I will describe three species which I have received from the East Indies.

Catoxantha gigantea is a large insect of upwards of three inches in length and nearly an inch in width; the elytra or wing-covers are metallic green with a large orange spot, surrounded by a beautiful blue band, on each; the thorax is of the same green colour, of a rather deeper shade, and has on either side a large coriaceous knob of deep chestnut; the eyes and antennæ are brown, and the legs black. The distinguishing characteristic of this genus, and from which it takes its name, is the colour of the abdomen, which is a bright orange yellow above and beneath.

Chrysochroa Buquetti is a magnificent Buprestis of about two inches in length by half an inch in width, with the head and thorax of a fiery copper, deeply punctured, the centre of the thorax is rich burnished violet; the eyes are dark brown, and the antennæ almost black; the elytra bright orange, with the tips, outer margin, and a large spot in the centre of each, of a most splendid purple; the abdomen, above, is of the same rich violet as the patch on the thorax, and beneath, Prussian blue with a metallic lustre; the under side of the head and thorax is coppery carmine, like that which adorns the upper side of the thorax, and is densely covered with a fine fulvous down.

Chrysochroa vittata is one of those, before mentioned, which is sometimes worn as an ornament; it is rather longer than the preceding species, of a deep green colour, with the base of the thorax, a stripe down each elytron, and the whole of the under surface, carmine glossed with gold.

Amongst the Canadian species, belonging to this family, bronze is the prevailing colour, although, of course, there are individuals in some of the groups which are very highly coloured. They may be at once recognised by the most uninitiated from the following characteristics: Most of the tribes have conical, wedge-shaped bodies of peculiar hardness, and the different parts so intimately connected as scarcely to show the point of union. Fig. 36 gives a very good general idea of the outline during the different stages. The head of the imago, or perfect insect, *d* is sunk into the prothorax, or part where the first pair of legs is attached, almost as far as the elliptical eyes, the prothorax in its turn fits closely into the mesothorax, or part where the second pair of legs is attached, and the posternum is prolonged into a sharp spike-like appendage, and fits tightly into the excavated mesosternum. The head is flat, and on account of being sunk so deeply into the thorax, is not capable of much movement, so, consequently, has the mouth, which is furnished with two stout mandibles, underneath. The antennæ, which are serrate and composed of eleven short joints, are inserted in small hollows on the front; the outer joints in most cases have some minute pores, which are either diffused on the sides or collected in small hollows (foveæ) on the lower margin, or the extremity. These are of great importance in classification, and were supposed by Erichson, their discoverer, to be olfactory.

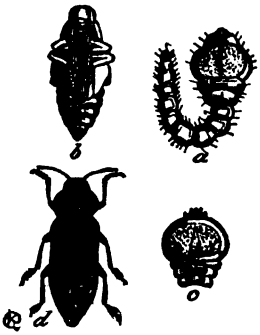


Fig. 36.

The elytra, which (in our Canadian species) are generally furrowed or granulated, are of an exceedingly hard consistency, so hard, in fact, as in some of the larger species to require considerable dexterity to pierce them without turning the tip of the pin; they nearly always cover the upper surface of the abdomen, the under surface of which is composed of five segments, and has the two first connate. Sometimes in the males there is a small sixth joint left visible, by the fifth one having a notch in the middle. The females are provided with an ovipositor, composed of three horny pieces, with which they are able to thrust their eggs into the smallest crevices of the bark of the tree, which is to form the nursery and food of the young larvæ. The legs are short, having the upper joints (*femora*) stout, and sometimes bearing a spur, the second joints (*tibiæ*) are slender, with two small terminal spines, and the tarsi five jointed. On account of the shortness of their legs, they are not at all active in running. The best authorities seem to agree in saying that they have large wings and fly quickly; but I cannot say that my observations so far have led me to concur with this statement. The wings of all those which I have examined have been small in comparison to the weight of their bodies, not being quite so large as the elytra, and only having one small longitudinal fold at the apex. The chief protection of these beetles lies in the similarity of their appearance to the objects amongst which they are generally found. At the slightest provocation they draw their legs in tightly to their bodies and drop from the branch on which they may be resting or feeding, and, protected by their firm tegument, they can fall upon the hardest rocks with perfect safety. When they reach the ground they will lie perfectly still for a long time, and it requires sharp eyes indeed to detect them, unless the exact spot where they fell is noticed.

Notwithstanding that, on account of the number and beauty of the species, this family has always been a favourite one with entomologists, the lifehistories of its different tribes are still very incomplete; thisis owing chiefly to the fact that most of the larvæ mature in living trees, which renders the study of them very difficult. The larvæ throughout the whole family, are much more homogeneous than the perfect insects, and may be describedas yellowish-white, legless grubs, Fig. 36 *a*, of slender form, but having the prothoracic segment, Fig. 36 *c*, enormously widened in comparison to the rest of the body; this enlarged division is much flattened, and protected above and beneath with horny plates. The different stages of the Agrilini are not so regular as in the other tribes, and vary in accordance with the group to which they belong.

There seems to be much difference of opinion as to the time necessary for these insects to reach maturity. I am of opinion that the normal period is a year, the eggs being laid during one summer, and the perfect insects appearing in the next. At page 399 Vol. 10 of "The Transactions of the Linnæan Society," mention is made of a curious instance of retarded development. A specimen of *Buprestis splendens*, a Swedish species bearing a close resemblance to our *Ancylochira striata*, was found by a Mr. Montague in the act of emerging from its burrow in the wood of a desk which had stood in the Office of Works, at Guildhall, for 22 years. The insect, with the piece of wood containing the burrow, was sent to Sir Joseph Banks, who found on enquiry that the makers of the desk had obtained the plank from the Baltic. But even this is not the longest period an insect has been known to remain alive in timber. Dr. Fitch describes a longicorn beetle which made its exit from the leaf of a table, made of apple-wood, 28 years after the tree was cut down.

It is in the larval state that these insects are most injurious, when burrowing in the soft sap-wood beneath the bark, especially when in great numbers, as is frequently the case, they cause the death of many young trees by completely girdling them. Some species occasionally shew great partiality for an individual tree; *e.g.*, in a grove of pine saplings, near Ottawa, containing upwards of 100 trees, there are two upon which, at almost any time, I could find three or four *C. liberta*, but upon no other trees in that locality have I ever taken any at all. It is a notable fact that most insects prefer injured or diseased trees, and which, on that account, have a feebler growth than would ordinarily be the case. It is to these trees then that the horticulturist should pay especial attention when hunting for them. Many remedies have been proposed for the protection of trees from the ravages of borers, but the surest mode, and the one which has to be relied on chiefly, is hand-picking. First learn which are your enemies and which your friends, and then go to work to hunt them out steadily one by one. This at first seems an impossibility, but by carefully watching at the proper time to destroy the perfect insects, and with a little experience at larvæ hunting in the fall, an orchard may soon be cleared of its pests. Steps, of course, should also be taken to prevent the beetles from depositing their eggs upon the bark of the trees. The most effectual means is, luckily, an exceedingly simple and inexpensive one. It is a well known fact that alkalies, although so beneficial to vegetable life, are particularly obnoxious to all insects, and consequently all compounds containing these will improve the former and protect them against the latter. Common soap, it will be found, is one of the best preventatives that can be used, and no insect will lay its eggs upon trees that are treated with it. The most convenient way to use it is to boil up as much as is required to the consistency of a thick wash, and then, with a hard broom brush it well over the trunks of the trees; this should be done about three or four times during the months of June and July. I may here mention that I have used, with very great success, in England, as a remedy against the canker-worm, coarse, common, oil, painted over the bark in the same manner. I have never tried it yet for Coleopterous larvæ, but I see no reason why it should not be as useful with them as with Lepidoptera.

In Entomology, however, as in most other sciences, if the evidences can only be found, man's greatest ally is that marvellous balance of Nature which is so wondrously kept up by a beneficent Providence. When a foe appears in any locality, let it be what it may, we know that, before long, there will be some counter-acting agent provided by Nature; the only question is— what will be the best remedy to employ until that is developed? This point, of counter-agents, is an interesting one in the history of the different pests which have devastated our crops from time to time, and deserves much more attention than it has yet received. I am convinced that were parasitical insects, and insectivorous birds, recognized as friends and protected as such, there would very soon be a noticeable diminution in the ranks of our insect scourges. When by cultivation of a certain plant, man furnishes a class of insects with their favourite food, he must expect those insects very soon to appear, and should then protect and foster, or even introduce, such birds as will feed upon, and keep in check, these ruthless destroyers; but they in their turn must also be restrained: he must not protect them blindly, or he will soon find that his remedy is worse than the disease, for they will increase so much that they will be stronger than he, and will be to a greater extent bad masters than they were valuable servants before. This has actually been the case in Australia, and some parts of the United States, with the English sparrows. They were imported in large numbers to check the ravages of insects, and being protected everywhere, very soon increased so enormously that they not only devoured the insects, but also the corn which they were called in to protect, and became so impudent that they drove away all the little warblers and other singing birds which individually (as they lived entirely on insects) were more useful than themselves.

Amongst birds, there are none which are so useful to the fruit-grower as the various woodpeckers. These active, good natured, beautiful fellows, wage a continuous and relentless war, in our behalf, against those invisible legions which attack almost every tree man wishes to propagate. I have frequently stood within a few yards, watching admiringly, as with their sharp beaks and curious barbed tongues they have dislodged from their snug burrows in the trunk of a tree the fat grubs of some borer, and when they have found one, they will hold it for a second in their beaks, as if to say, "Look! see how hard I am working for you. Look at this slippery rascal which I have caught and which has eluded your closest search." Poor fellows, their bright livery and confiding nature are too often the cause of their death. It always grieves me to see thoughtless people shooting them. It is such a cowardly act, for they never attempt to avoid you, but work away, as if they had not a moment to lose, in hunting out our enemies, and will allow you to approach within a few feet of them. Many people think that by perforating the bark, in the wholesale way they do sometimes injure the trees; but it has been shown by the observations of Wilson, the celebrated American Ornithologist, that, on the other hand, it is actually beneficial to them. The absurdity of the charge of "sucking the sap," which has sometimes been brought up against these birds, is at once shown by an examination of their tongues, when it will be seen that it is a physical impossibility.

The whole of the Canadian Buprestidæ are contained in the two tribes *Buprestini* and *Agrilini*, and the greater number in the former of these.

BUPRESTINI.

In this tribe the front is not usually contracted by the insertion of the antennæ; the prosternum is angulated on the sides, behind the coxæ, and its lateral sutures are oblique;

the mesosternum is always divided, so that the cavity for the reception of the prosternum is formed both by the meso and metasternum; the side pieces of the latter are always visible, and the epimera are triangular. The hind coxæ are broader internally; their anterior margin is straight and transverse; the hind margin is oblique. The antennal pores are diffused on the sides of the joints in the first group, and concentrated in marginal foveæ in the others. The species are more or less flattened in form.

Our groups are the following:—

Epimera of Metathorax triangular, uncovered: Prosternum obtusely angulated behind the Coxæ;
Metasternum and mesosternum closely united........................ CHALCOPHORÆ.
Mesosternal suture distinct .... BUPRESTES.

Epimera of Metathorax partly covered by abdomen; Prosternum acutely angulated behind the Coxæ;
Front not contracted by insertion of antennæ .... ANTHAXIÆ.
Front contracted by insertion of antennæ .... CHRYSOBOTHRES.

GROUP I.—CHALCOPHORÆ.

This group is represented in Canada by the sole genus Chalcophora, the species of which are insects of large size, readily known by the antennal pores being diffused on the sides of the joints.

Amongst the most beautiful is *Chalcophora liberta*, Fitch, which is about ¾ of an inch in length, of a beautiful golden bronze; the colour, however, varies; some I have taken being coppery, bronze glossed with green, and even black. This is a very common species around Ottawa, and can generally be found on young pine trees during the summer and fall; it usually feeds and rests on the tips of branches, with its head turned in, and then bears a close resemblance to the young cones. The broadly rounded sides of the thorax, the deep dorsal grooves and the entire sutural stria well distinguish this species.

GROUP II.—BUPRESTES.

In this group the sides of the posterior part of the prosternum are straight, or very feebly angulated, the apex is broad and obtusely rounded in most of the genera, but sometimes acute. The meso and metasternum are closely united by a transverse suture, and the former is deeply excavated through its whole length for the reception of the prosternum. The species are of moderate size and usually of elongated form: the attennal cavities are small and the front is not lobed before the antennæ; the pores of the latter are placed in foveæ situated on the inferior margin of the joints, except in Cinyra, where they are terminal: the elytra are not serrate in any of our species.

Our genera may be arranged as follows:

Prosternum obtusely rounded behind;
Mentum entirely corneous;
Scutellum, small, rounded ....DICERCA.
Scutellum, very transverse, truncate ....PŒCILONOTA.
Mentum, membranous anteriorly ....ANCYLOCHIRA.
Prosternum, acute at tip ....CINYRA.

DICERCA.

This genus contains many species, all of which are remarkable for the shape, which is ovoid, with the tips of the elytra prolonged into a kind of tail with the two points more or less convergent.

The following may be taken as typical species of the genus:

D. divaricata, Say, a thickly punctured beetle of a coppery lustre, sometimes brassy above, the wing-cases striated and freckled with numerous fine irregular impressed lines and small oblong black spots, their ends prolonged and slightly spreading at the tips, where they end abruptly as if broken off; the length varies from 0.70 to 0.90; the middle of the breast is furrowed, and the males have a conspicuous tooth on the inferior margin of the middle tibiæ. This is one of the commonest of the Buprestidæ and may generally be found upon old beech or cherry trees in June, July and August. I once found a specimen on a pine tree in September, but I think it was only there by chance.

D. lurida, Fabr, is a blackish copper above, and of a much brighter shade underneath; the thorax, especially in the smaller males, is impressed on each side behind the middle; the elytra which are narrowed behind, but very little prolonged, have two teeth at their tips, the surface is rather rough with numerous irregular impressed lines or punctures and several narrow elevated black spots. The end of the abdomen in the female has three teeth, the middle one acute. Length 0.60–0.80. The larva feeds upon the hickory.

D. spreta, Lap. This is a rather rare, but very handsome species of about 0.65 in length. On the front is an irregular elevated line formed by the presence of a smooth concave callus in the middle and two smaller ones on each side; the thorax is much constricted behind the middle, with the surface very uneven at the sides; the external costæ are irregular and interrupted, and the dorsal canal is deepest at the apex, the smooth costæ limiting it are broad. The intermediate tibiæ are straight in both sexes; the under surface is densely punctured at the sides and nearly smooth in the middle, except the broad deep groove of the prosternum, which is coarsely punctured. The form is rather broader than most of the others of this genus. The bidentate elytra are deeply and boldly indented, the polished elevations having a reddish bronze tinge which is made conspicuous by the ground colour of the indentations which is a soft greenish grey, sometimes almost white in places, and gives the beetle the appearance of having been powdered and then polished on the elevations. Except in shape, which is more robust, this insect bears a close resemblance to *D. asperata.*

PŒCILONOTA.

The species of this genus present all the essential characters of Dicerca, except that the scutellum is very transverse and truncate, with the posterior angles well marked. Our species all have a smooth dorsal thoracic line, the antennal cavities are connected by a slight ridge, and the prosternum is hairy, characters never seen in Dicerca

P. cyanipes, Say. This is a most elegant species. One I have before me, taken by Mr. Saunders, at London, Ontario, is 0.60 in length, of a greenish bronze hue above, and the same colour burnished beneath; the elytra are evenly striped, with indented lines and thickly punctured, having their divergent ends drawn out into a tail, the colour of which is carmine touched with deep blue, the legs are coppery, and the tarsi a beautiful blue, which looks green in one light, and from which the species derives its name.

ANCYLOCHIRA

This is an extensive genus containing some very beautiful species, and is very widely distributed. Most of them are of a metallic lustre and have fulvous markings.

A Nuttalli, Kirby, is one of the handsomest of the bronze members of this genus. The length varies from 0.65 to 0.75. The elytra are deeply grooved, with longitudinal ridges, having the intervals distinctly punctured, and are marked with four unbroken bands of reddish-yellow, the outer ends of which converge so as to give the appearance of two broad circles with a cross lying on each. The thorax is broadly rounded and margined with the same yellow as marks the elytra. The prosternum has no marks; this is one of the chief points of difference between the present species and *A. Consularis.* The coxæ and femora are partly red, and the abdomen has a lateral spot on each segment.

CINYRA.

This genus is represented in our fauna by a single species, of exceedingly rare occurrence.

C. gracilipes, Mels, is a small insect measuring 0.40–0.44, with a slender, rather convex body, somewhat resembling an Agrilus. The head is punctured, with a smooth spot between the eyes; the lateral grooves of the thorax are less deep than the medial one, and the sides are perfectly straight. It is a brassy-coloured insect and bright copper-coloured beneath, with the elytra lightly striated and bidentate at the tips.

GROUP III.—ANTHAXIÆ.

Species of small size, usually flattened. Prosternum acutely angulated on the sides behind the coxæ, and acute at the tip; the mesosternum narrowly divided; the suture separating it from the metasternum distinct; scutellum small, rounded, or transverse; antennal pores placed in foveæ at the extremity of the inferior margin of the joints, the front not lobed before the antennæ.

There are but two genera :—

Mentum, coriaceous in front; prothorax, sinuate at base ....MELANOPHILA.
Mentum, entirely corneous; prothorax, truncate at base .... ANTHAXIA.

MELANOPHILA.

Insects of small size and sombre appearance, most of them being black; a few, however, have yellow spots on the elytra, which are more or less obscurely indented, thickly punctured, and sometimes spiniform at their extremities.

M. longipes, Say. This is by far the most active of all the Buprestidæ, running and flying with great quickness on bright days in summer. The body is black, not glossy; head minutely punctured, with a channel between the eyes; anteunæ nearly as long as the prothorax; prothorax with a large impression on each side, having its sides rounded and thickly punctured; scutellum nearly heart-shaped; elytra rough, with very numerous minute granules and large shallow impressions, terminated in a sharp tip. The legs are long and slender.

ANTHAXIA.

A small family of inconspicuous insects remarkable for their sculpture, consisting on the head and thorax of shallow punctures, with the intervening lines forming a fine network.

A. inornata, Randall. Thorax densely and strongly reticulated, much wider than long, with angles at the base, and the edges rounded; the elytra are uneven and densely granulated; they have two decided margins; the sides are parallel and abruptly narrowed and rounded at the apex; the colour is black with a tinge of bronze, and shining black beneath; length 0.23.

GROUP IV.—CHRYSOBOTHRES.

Antennæ inserted at the inner extremity of two short oblique grooves, by which the front is narrowed; before these grooves it is again widened, and the anterior margin is emarginate in an angular form; the prosternum is acutely angulated on the sides behind the coxæ, and acute at the tip; the mesosternum is larger than usual, and only narrowly divided; the scutellum acuminate; the elytra are rounded or sub-angulated at the base, and enter the base of the thorax; the femora are strongly lobed. The numerous species are of rather broad and of a flattened form, with the elytra impressed in the form of bands or spots; the sexual differences are in the shape of the anterior or middle tibiæ.

All the species found in Canada of this group belong to the genus CHRYSOBOTHRIS. Many of them are very similar, and difficult to identify.

C. Harrisii, Hentz. This lovely little species measures 0.30; the female is of a beautiful metallic green all over; the male has the legs and the sides of the thorax of a reddish bronze, and a purplish tinge towards the tips of the elytra; the thorax has a conspicuous furrow down its centre, and is marked with some irregular indentations, which are also found on the finely punctured elytra; the costæ on these latter organs are very indistinct, and the outer margins finely serrate. I have taken this at Ottawa in some abundance, on white pine saplings, towards the end of June. It is a very agile species.

AGRILINI.

In this tribe the species are generally slender, sometimes, however, very broad and flat; in both cases the body is narrowed behind. The front is strongly narrowed by the insertion of the antennæ; the anterior part of the head is vertical; the mouth inferior and applied to the prosternum in repose; the mentum is large; prothorax lobed at the base; prosternum broad in front, with oblique sutures, cuneate behind, and scarcely angulated behind the coxæ; the small mesosternum is completely divided.

There are two groups in our fauna:

Antennæ free ....AGRILI.
Antennæ received in grooves..BRACHES.

GROUP I.—AGRILI.

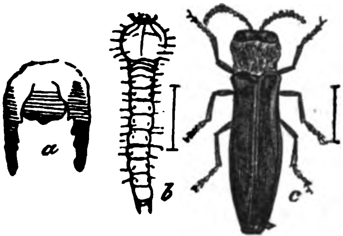


Fig. 37.

This group is well represented by the extensive, and difficult to determine, genus AGRILUS.

The body is laways elongated, and generally constricted about the middle. The species are small, and are found on flowers and leaves

A. bilineatus, Weber. A handsome insect, measuring 0.28—0.37, of a deep invilsibegreen; head and thorax black and granulated, elytra more finely so; starting from the mouth and running down the sides of the thorax, then dividing and going down both margins of the elytra, is a beautiful line of golden pubescence; this is very conspicuous down the middle of the back. The elytra are serrate at the apex

A ruficollis, Fab. The red-necked agrilus, fig. 37, another member of this interesting group, is also a very handsome insect, which, in the larval state, bores into the canes of the raspberry and blackberry.

GROUP II.—BRACHES.

Body usually broad or ovate, rarely elongated; sides of the thorax deeply grooved beneath for the reception of the antennæ; legs very contractile, the tibiæ usually sulcate for the reception of the tarsi; scutellum triangular. The larvæ of this group are leaf miners eating the parenchyma and transforming in the burrows. The genera are divided —as follows:—

Body elongate; prosternum pointed behind ....TAPHROCERUS.
Body ovate; prosternum obtuse behind; tibiæ linear......BRACHYS.

TAPHROCERUS.

Chiefly distinguished by having the body elongate and the claws simple and connate at the base, and a lobe in the centre of the prothorax.

T. gracilis, Say. A small insect, only measuring 0.14—0.21; of a blackish bronze colour, with patches of minute white hair on the rather coarsely punctured elytra; the front has a wide furrow down the centre, and the elytra are sunk into a groove at the apex.

BRACHYS.

Insects of ovate form, with the thorax strongly bisinuate at the base, with the median lobe hollowed. Scutellum moderately large.

B. ovata, Weber. Measures 0.19—0.25. Head with a deep sinus and the face covered with minute decumbent hairs; elytra beautifully variegated with blotches of gold and silver hairs and with three ridges, the external one acute and running from the shoulder almost to the apex; of a deep purple.

NOTES OF THE YEAR.

By B. Gott, Arkona, Ont.

Mutation and variation are palpably stamped upon all things terrestrial. There is nothing of and from the earth that is not more or less subject to action and reaction, to removal and change. This statement is true also of the seasons of the year; one season differs from another, comes on earlier, is more distinctly marked, or lasts longer or later than those preceding. The distinctive features of this year have been, first, a short and mild winter, and the early activity of vegetable and insect life, and consequent early maturity. So early as the 6th day of March (when in past seasons at this date all was firmly shut up in the iron grasp of winter), a beautiful balmy spring time burst upon us, which had the effect of immediately awakening into activity both vegetable and insect life to a most surprising extent. The mission work of insects, and their beneficial services to vegetation, is now very generally admitted by the ablest and best authorities on natural history, in the fertilization of plant germs, involving the useful and advantageous work of crossing and improving varieties. It would thus appear that all are necessary in their time and place; none are created uselessly or without a distinctive purpose. The seasons of spring and summer seemed throughout a month earlier than usual. Another characteristic of this year was its intense heat in July, followed by its prevalent dampness in August and September. This dampness caused the putrefaction and destruction of very large quantities of fruit and vegetable matter, and such insects as live on these decaying substances were generated in abundance, which laboured in the removal of these noxious substances from the earth.

But it is not of these useful creatures we are disposed to complain and wage war on; it is on those who trespass on our rights and privileges, by destroying the fruits and cereals we cultivate, and on which our prosperity and wealth largely depend. The abundance of some forms of insect life are largely due to the altered conditions which settlement and the clearing of the forests have brought about. By this means the equilibrium of nature in this respect has been disturbed, while the few varieties of plants and fruits we cultivate are grown in such quantities as to supply food to an unlimited extent to the insect hordes which feed upon them, and since the abundance of insect life is usually largely dependent on the supply of food, a constant warfare is necessary to keep such as are injurious within due bounds.

In this we are helped by birds, and also by friendly parasitic and carnivorous insects. In this connection the advantages of the study of Entomology are clearly manifest, since by this means we obtain an insight into the life-history of the various species, learn their habits, and, after some observation and study, are enabled to distinguish our friends from our foes among the insect tribes, and while we wage war on those which injure us, throw the shield of our protection about our tiny helpers.

1. The Hessian Fly (*Cecidomyia destructor*), and American Wheat Midge (*C. Tritici*).

In the fall of the year 1877, throughout this country and some of the States of the American Union, there was a grievous and general outcry occasioned by the ravages of the first of these wheat insects. The small dipterous insect known by this name lays its eggs quite early, and the young larva, developed therefrom in the months of October and November, feeds upon the young growing wheat plant, and robs it of nourishment and causes it to look sickly and wither away. When these insects are present in great numbers, whole acres, and even fields of wheat, will assume this disheartening appearance. It is a great and general evil, and is clearly on the increase; but the farmers this season have taken precautionary measures, and forebore to sow their wheat as early as usual, this being considered one of the remedial measures. Many other precautionary and helpful remedies are likely to be adopted. The prevalence of the second wheat fly was not very general, and was only noticed in some specimens of spring wheat. This insect, unlike the other, feeds only upon the young and tender grains. It is to be hoped for the safety of our crops that these insects may be speedily checked in their destructive work.

2. THE AMERICAN LACKEY WORMS (*Clisiocampa Americana* and *C. sylvatica*).

These worms as usual were amongst us in considerable numbers this spring, and began to work very early, but their ravages were of a decidedly mild type and were not to be dreaded as in former years. A singular mortality possessed them, for while just at their work upon the leaves many of them were seized with death and speedily changed to corruption; many others fell a prey to the larvæ of Ichnumon flies, so that really but few got through. These followed the instincts of their being, and commenced to form egg clusters on the young apple twigs as early as the 10th of July, but they are not numerous.

3. THE CURRANT WORM (*Nematus ventricosus*).

This insect proves itself to be a real pest, most persistent and destructive, and, as far as we can discern, without any redeeming qualities. They appeared and began to work unusually early (April 27th) this year, and kept up vigorously until every currant and gooseberry bush was completely stripped. Our remedy, White Helebore, would have helped us over the difficulty nicely; but when just at the point of conquest a second brood appeared in multitudes and baffled our efforts. This is the worst insect of the season, and our three or four hundred bushes only lasted them a few days.

4. THE GOOSEBERRY FRUIT WORM (*Pempelia grossularia*).

This insect is akin to the currant worm, also a real foe, and a most insidious enemy. They appeared on the field of action quite early in the season, and in great numbers, and succeeded in filching from our grasp fully two-thirds of our promising crop. These two insects have reduced gooseberry and currant growing in this country to a very arduous and unsatisfactory experiment. We like the fruits of these familiar shrubs and would prefer to grow them, but we felt this summer almost on the verge of despair. However, we still hope that some friendly parasite will yet come to the rescue and assist in our dilemma.

5. THE POTATO BEETLE (*Doryphora decemlineata*).

These beetles appeared a little earlier than usual, but on account of the extreme earliness of the season were just in time. Although they came in great numbers they were not to say troublesome, for careful and constant hand picking was all that was necessary to keep them in check, so they did not do us any appreciable harm. We noticed that their work was feeble and their movements slow and dull while in the perfect state. The scare caused by their appearance is pretty well subsided at present.

6. THE PLUM CURCULIO OR WEEVIL (*Conotrachelus nenuphar*).

This old and familiar depredator is really a bad case, full of mischief and decidedly of a business turn. In locations where the soil was light he had a good chance, and the whole crop of plums were taken, notwithstanding our efforts at jarring, smoking, &c.; but on heavy and cold clay soils the plums came off victoriously, producing a beautiful crop of clean, handsome fruit. Plums this year were very plentiful and very cheap. We think we are on the whole gaining a little on this enemy of a very popular and good fruit.

7. THE APPLE FRUIT WORM (*Carpocapsa pomonella*).

No very new developments have been made during the season respecting this insect or its work. It is evident, however, that this insect has come among us to stay, and that it means to prosper to the damage of the apple crops of this country. Although the product of fruit in many places was small, very small, yet the work of this insect was plainly discernible. We attempted to capture the worms in old cloths laid in the main crotches of the trees, but succeeded only to a very limited extent. I have noticed two insects, new to me, of gregarious habit, feeding in great numbers on the leaves of the apple trees, viz.:

8. DATANA MINISTRA AND NOTODONTA CONCINNA.

These insects are, each of them voracious feeders ; the whole brood working together on a selected branch of the tree will strip it to the tip ; they then descend and repeat the operation on another, and thus they soon defoliate a tree of moderate size. But the character of their work soon makes them very conspicuous, and they are easily destroyed by removing them from the tree as soon as observed. I have no apprehension that they will become very troublesome, or succeed to any very great extent. It is well to be cautious however.

9. THE PEA BEETLE (*Bruchus pisi*).

This insect has now become an old resident, and his appearance may always be safely calculated upon. The pea crop this season has suffered much in loss of weight from the effects of this weevil. I shall not soon forget being in one of our grain stores in September, the mass of active beetles there made it appear more like a bee hive than a grain store, the numbers of them flying about was something immense. Nothing appears to be done to check them, and our farmers consequently suffer much.

10. THE CABBAGE WORM (*Pieris rapæ*).

This importation promises to be more than a visitor, and is something to be dreaded. Its rate of increase will render cabbage growing a difficult and hazardous task, and anything but lucrative at five cents a head. The familiar white butterflies were remarkably thick during the months of August, September and October, and their vigilance in observing was something remarkable, not a solitary specimen escaping their visitation. In every case they soon rendered the fair leaves of cabbage, a mass of rags tattered and torn, as though subject lately to a heavy charge of fine shot.

11. MAY BEETLES (*Phyllopaga quercina.*)

This old beetle is very much on the increase, and the ground in nice, dry and warm situations is plentifully supplied with its larvæ. They are heavy feeders, and devour the roots of plants, &c., and especially are their feedings felt by potato growers ; they eating unsightly holes in those tubers, and thus very much injuring the crop. We know of no effectual remedy in this matter.

12. THE ROSE LEAF SLUG (*Selandria rosæ*).

This inconspicuous insect is growing much more troublesome, and is on the increase, and, if neglected, is likely to prove disastrous to the interests of rose growers. It matters but little how fair and lovely the variety, or how much labour has been lavished upon it, if only neglected a few days in June, it will become as though singed by fire, and every part of the green removed from the leaves, and nothing left but a sere and faded specimen of what was before a beautiful rose bush. This is the work of this insidious insect Soap suds or dressings of tobacco water are effectual, so also is hellebore and water, in removing them, and it is only the negligent and careless that are most apt to suffer.

13. WOOLLY APHIDES (*Aphis lanigera and also the Black Aphis of the Cherry*)

have been remarkably abundant and injurious from the commencement of the season. In the case of the cherry, this was very noticeable. I never saw them so badly affected from this cause. A dense mass of black, active aphis gathered rapidly and thickly upon the young growth, and fed upon the juices of the tender shoots and leaves, and caused them to curl up in unnatural shapes, and eventually resulted in a total suspension of growth, and, in short, withered away. This effect we felt most severely upon small trees and young budded stocks ; but the same was noticeable also on larger trees. The woolly aphis we complain of feeds mostly upon young apple trees, and does them much injury. The only remedies we know is anointing the parts with oil or varnish.

INSECT REGISTER FOR 1878.

March 6th.—Weather warm and beautifully spring-like, several small insects on the wing in the bright sunshine, and the honey bees are swiftly flitting across the fields.

March 7th.—Observed several insects in activity, both on the ground and on trees.

March 9th.—Found some fine moths, both male and female, of what are supposed to be *Anisoptery Vernata;* also caught the first fine buzzing mosquito.

March 21st.—Discovered mature May beetles about an inch from the surface of the ground.

April 11th.—Observed the first young tent-caterpillars in activity on the cluster.

April 15th.—Grape vine flea beetles observed at work on the buds of our grape vines; we commenced our war of extermination by vigilant hand picking.

Aprll 20th.—May beetles remarkably thick on the wing this evening; a loud buzzing is kept up by their activity and numbers.

April 27.—Currant worms, (*Nematus ventricosus*) first observed at work on the young leaves of the gooseberry and currant bushes.

May 1st.—Great numbers of currant worms are feeding on the bushes and threatening to totally strip them; applied powdered white hellebore in solution.

May 2nd.—First potato beetles' eggs observed on the rising young plants. The beetles wait patiently for their appearance.

May 3rd.—Flies, butterflies and moths on the wing in great numbers and joyful activity Spring has certainly advanced.

May 4th.—Young tent-caterpillars first moult; they are thriving well.

May 5th.—Bark lice, Woolly aphis and cherry aphidians are present on young growth in great numbers.

May 6th.—Measuring worms and leaf rollers began to work; their numbers are threatening to be great, inspiring alarm.

May 10th.—We assisted our first Cecropia moth (*Attacus cecropia*) in its release from imprisonment and winter confinement. It is a great beauty, admired by all.

May 15th.—The gooseberry bushes are literally alive with ravenous currant worms, totally denuding them of all their foliage. This is the *pest* of the season.

May 20th.—Plum curculios first observed in their attacks on the young fruit. We tried jarring and smoking them.

May 25th.—First full grown tent-caterpillar observed; these worms begin to travel, but are not nearly so numerous or so destructive as they were last year.

May 26th.—First observed the effects of the gooseberry fruit worm, *Pempelia grossularia*, on the young gooseberries; many berries are dying and emptied of contents.

June 15th.—First tent-caterpillar observed as a chrysalid.

June 19th.—The pea beetle, *Bruchus pisi*, observed at work on the young peas.

June 20th.—The second brood of currant worms hatching very thickly; they are very abundant and quite discouraging.

June 24th.—The tent-caterpillar pupæ appear to be very generally injured by the larvæ of ichneumon flies; those flies are very abundant and very searching in their operations.

June 26th.—Observed first perfect young tent-caterpillar moth, active and on the wing.

June 29th.—Captured a fine hellgramite fly.

July 1st.—Stag beetles, *Lucanus*, began to be active and abundant, especially in the evening.

July 2nd.—Captured first grape vine beetle, *Pelidnota punctata*, on the grape vine; they are not very abundant or very injurious.

July 10th.—Observed first new collection of tent-caterpillar's eggs on apple shoots.

July 19th—Codling moth larva first observed to be preparing for pupation in an old rag in a branch of a tree.

July 24th.—Captured a fine young moth, *Sphinx quinque-maculata*, just released from its confinement.

July 27th.—Captured some fine larvæ of the moth, *Attacus cecropia*, on young apple branches.

July 28th.—Found a large collection of fine larvæ of the moth, *Datana ministra*, on an apple tree.

Aug. 10th.—Captured a large quantity of larvæ of the moth, *Notodonta concinna*, on an apple tree.

Aug 21st.—Found a fine and beautiful larva of a Tussock moth, *Orgya leucostigma*, on the leaves of an apple tree.

Sept. 25th.—White cabbage butterflies are unusually plentiful this season; are actively depositing eggs on every available specimen.

Sept. 30th.—Captured a fine and beautiful sphinx moth.

Oct. 16th.—Captured a beautiful butterfly flitting in the sun.

Oct. 20th.—We have made a very fine collection of beautiful insects this season; both butterflies and moths, large and small. It is much admired.

Nov. 1st.—Most of the insects of our acquaintance, with all their vigilance and destructiveness, their beauty of colour and form, and their wonderful mechanism of parts, have gone to rest for this season.

ON A RARE CANADIAN BUTTERFLY.

Papilio cresphontes Cram.

BY WILLIAM SAUNDERS, LONDON, ONT.

This handsome swallow-tail butterfly formerly known as Papilio thoas is essentially a Southern insect, quite common throughout the Southern States, where it feeds in the larval condition upon the foliage of the orange and lemon trees. When first discovered it was thought to be restricted to the South, but more thorough investigation has shown that it is much more widely distributed. It has been found in Michigan, Iowa, Kansas, Illinois, Wisconsin, Connecticut, and also in several localities in the western part of Ontario, particularly in the south-western portion of the County of Lambton, and in the neighbourhood of Amherstburg, Co. Essex, it has also been taken at Hamilton and Dundas, and has been seen on the wing at St. Thomas. It occurs throughout the month of June and also in August.

This is a very beautiful insect. The accompanying cut figure 38, in which it is very faithfully delineated was drawn and engraved by Mr. Worthington G. Smith, of London, England, from a fine specimen captured by Mr. J. M. Denton, near Amherstburg.

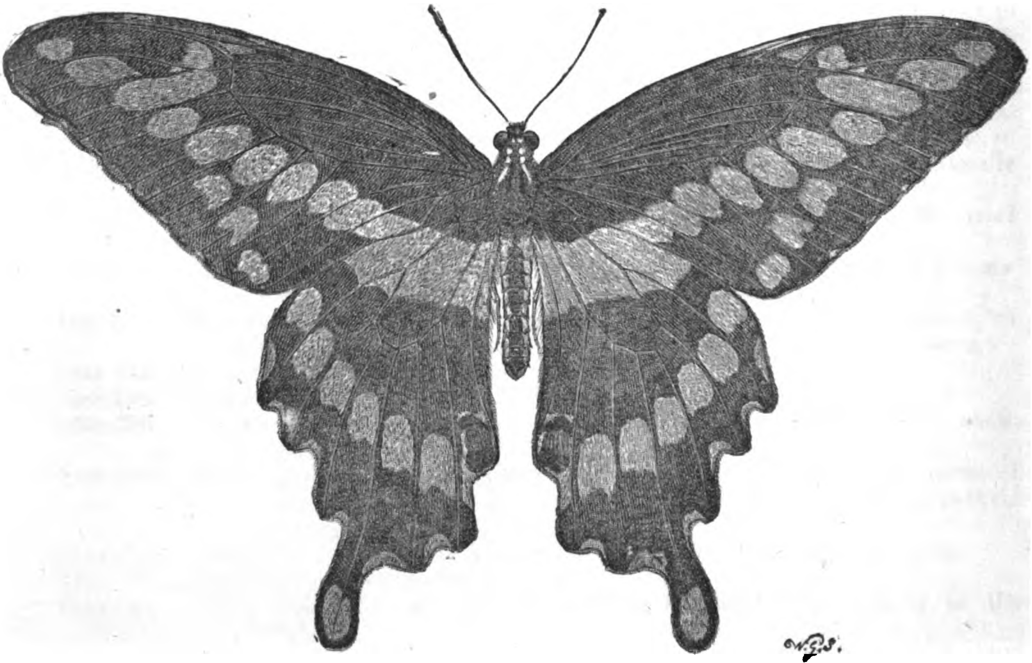


Fig. 38.

The wings are of a deep black colour, crossed by a band of yellow spots extending from tip to tip of the fore wings and covering also the front margin of the hind wings. The third spot from the tip is oblong, sometimes notched by encroachment of the ground colour, and surmounted by two or three smaller spots; there is also a row of three or four spots below the band, extending to the inner angle. The hind wings are also furnished with a row of six or seven yellow spots, while the anal angle has a reddish crescent with a patch powdered with blue atoms above it. The edges of these wings are notched, and more or less fringed with yellow, the tail is black with an oval, yellow spot; the body is also black marked with yellow. When its wings are expanded it measures about five inches, sometimes more.

This stately creature is very active when on the wing and difficult to capture, but when it has alighted and is busily engaged in sucking the nectar of flowers, if cautiously approached, it may be taken without much difficulty.

Last September, I was much gratified at receiving a number of the singular caterpillars of this beautiful butterfly from Mr. S. Eccles, of St. Thomas. They were found in his garden, feeding on *Dictamnus flaxinella*, a perrenial herb, which is a native of Southern Europe, but cultivated in this country in gardens, as an ornamental plant. The larva is a very strange looking creature. On the first four segments of the body there is a white lateral band beginning from the head, and between that and the corresponding one on the opposite side, there is a large brown patch, marked by large brownish black spots. Behind this, about the middle of the body there is a large white spot in the shape of a lozenge, which covers the back and a part of the sides, one of the angles of which reaches the first pair of fleshy pro-legs. In the middle of that band there are some brown spots. The hinder part of the body is covered by another large white patch marked anteriorly with some brown spots; the sides of the body, between the lozenge-shaped and the last white patch are of a uniform dark brown colour. The underside is also brown as well as the feet.

This curious mixture of white grey and brown colours is so arranged as to make the larvæ closely resemble the excrement of birds. This is especially so during the earlier stages of their growth; doubtless this resemblance protects them against their enemies, especially the birds. When touched they stretch forth a reddish brown fleshy fork from behind the head, which is also used as a defence against their enemies.

For a few days, while fresh food of *Dictamnus* was at hand, the larvæ did well and grew rapidly, but the supply failing they were transferred to a young orange tree, which was enclosed in a gauze bag to prevent their escape—when they lost their vigour and activity, and although they ate more or less of the foliage every day, they lost flesh and one after another died, until only three or four remained. These lingered for a time when two of them spun up and went into chrysalis, but the chrysalids were small and one of them deformed, and finally the remainder all died. Subsequently the chrysalids became stiff and hard, and on opening them they were were found dead and dry.

The chrysalis is brown, marked with blackish points.

The skill shown by this butterfly in selecting the plants and trees on which to deposit its eggs is very wonderful. The caterpillar, as far as is known feeds only on species belonging to the Rutaceæ or Rue family, which comprises genera and species singularly unlike each other; yet this butterfly knows how to recognize and select them. *Dictamnus* belongs to this family, so also does the common garden rue *Ruta graveolens*. The other members found in this country are the Northern Prickly Ash *Zanthoxylum Americanum*, the Southern Prickly Ash, *Z. Carolinianum*; the hop tree *Ptelea trifoliata* and the genus *Citrus* which includes the sweet and bitter orange, the lemon, lime and citron. In the South, the larva, as already stated feeds on the various trees belonging to the latter family, in the West it feeds on the Prickly Ash, while in Kansas it is known to feed on the hop tree. Having been found on *Dictamnus* it becomes highly probable that it will feed also on Rue, although it has not yet been found on this plant.

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ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF THE

PROVINCE OF ONTARIO,

FOR THE YEAR

1879.

Printed by Order of the Legislative Assembly.

Toronto:
PRINTED BY C. BLACKETT ROBINSON, 5 JORDAN STREET.
1880.

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ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

FOR THE YEAR 1879.

INCLUDING REPORTS ON SOME OF THE NOXIOUS, BENEFICIAL, AND OTHER INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE ON BEHALF OF THE SOCIETY.

BY

WILLIAM SAUNDERS,
President of the Entomological Society; Editor of the Canadian Entomologist, London.

JAMES FLETCHER,
Vice-President of the Entomological Society, Ottawa.

REV. C. J. S. BETHUNE, M.A.,
Head Master of Trinity College School, Port Hope.

G. J. BOWLES,
President of the Montreal Branch, Montreal.

W. H. HARRINGTON,
Ottawa.

AND

B. GOTT,
Arkona.

REPORT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE YEAR 1879.

To the Honourable the Commisioner of Agriculture:

SIR,—In accordance with the provisions of the Statute, I have the honour to submit for your consideration the Annual Report of the Entomological Society of Ontario for the year 1879, in which is contained an account of our financial condition, the reports of the Council and of our several branches, also such papers from our members as we think most adapted to the wants of our agriculturists, and most likely to further the design of the Department in promoting the knowledge of practical Entomology.

The *Canadian Entomologist* has now completed its eleventh volume. Appearing as it does monthly, with an ever widening circle of influence, it cannot but have great and beneficial effects upon the agricultural interests of the Dominion, rendering by timely warning and advice, such information as has afforded much protection against the noxious insects that are ever invading our crops. It has been well supported by able contributions from our members and is favourably looked upon by its readers.

Were our funds sufficient we would gladly introduce a much greater number of appropriate cuts which would make our journal more acceptable and valuable to the community, as, with suitable illustrations, the articles it contains would be much more readily understood.

The annual meeting of the Society was held at Ottawa, at the time of the Dominion Exhibition, when the reports of the officers, duly audited, were presented and approved of, also officers for 1880 were elected. The Society's collection of insects was on exhibition there and was awarded the Dominion Gold Medal.

The articles contained in the report are, we trust, such as will prove interesting and useful to the public and especially to agriculturists, for whose benefit they are particularly intended. We also trust that they will meet with your approval.

I have the honour to remain, Sir,
Your obedient servant,
James H. Bowman.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The ninth annual meeting of the Entomological Society of Ontario, was held in Ottawa, in the Museum of the Ottawa Literary and Scientific Society, on Thursday the 25th of September, at 4.30 p.m. In addition to the members of the Society, there were present on invitation about twenty members of the Ottawa Field Naturalists' Club.

In the absence of the Secretary-Treasurer, Mr. Jas. Fletcher was appointed Secretary *pro tem.*

The President read a telegram which he had received from the Vice-President, regretting that important engagements prevented him from being present.

The annual statement of the Secretary-Treasurer was read and adopted.

ANNUAL STATEMENT OF THE SECRETARY-TREASURER, ENTOMOLOGICAL SOCIETY OF ONTARIO, SEPT., 1879.

Receipts.

To Balance from 1878	$191 08
" Members' Fees, and sales of *Entomologist*	229 78
" Mdse. pins, lists, cork	29 16
" Advertisements	20 00
" Interest	12 57
" Government Grant	750 00
	$1,232 59

Disbursements.

By Postage	$20 25
" Expenses of Council, Delegations, &c.	65 00
" Petty expenses, freight, &c	10 75
" Annual vote to Editor and Secretary	150 00
" Expenses on Annual Report	149 74
" Engraving	13 45
" Mdse, pins	63 90
" Printing *Entomologist*	373 20
" Mailing "	32 00
" Paper for "	84 80
" Insurance	10 63
" Library	26 25
" Rent for 1879	80 00
Balance in hand	152 62
	$1232 59

We certify the above to be correct.

Sept. 18th, 1879.

CHAS. CHAPMAN, } *Auditors.*
ABM. PUDDICOMBE, }

The report of the Council was read and adopted.

REPORT OF THE COUNCIL.

Your Council feel highly gratified at the success which has attended the efforts of the Society during the past year. Nine years have now passed since our incorporation; these have all been prosperous years, and the one we have just completed has not been less so than any of its predecessors. All the operations of the Society have been carried on harmoniously, and we have been able to present the public with many of the results of your investigations which will prove of value to it.

Our Report to the Government, which you have all had the opportunity of perusing, continues to maintain its interest, if we may judge by the manner in which it is sought after. We think that it is perhaps our best medium for reaching those whose knowledge of Entomology is limited, and to whom it is necessary to present the science in its more elementary and popular forms, if we would create a taste for its study. The fact that our reports are so much in demand indicate that the science of practical Entomology is rapidly growing in favour among the more intelligent of our agriculturists.

The new enterprise of the "Fruit Growers' Association," the publication of the *Horticulturist*, to the pages of which your members contribute largely, will, we trust, be a means of still more widely diffusing Entomological knowledge, as this journal enters the homes of nearly all our horticulturists, and in addition to the many valuable papers on fruits and flowers which it contains, it carries much information on our noxious and beneficial insects.

One great drawback to the Society's efforts has been the lack of funds to carry on its operations, and to enable us to procure woodcuts and electrotypes to illustrate the pages of our journal. We are satisfied that without figures of the insects we treat of, much of our labour is lost as far as the general public is concerned; we earnestly hope that before long our annual grant may be sufficiently increased to enable us to overcome this difficulty.

Our journal, *The Canadian Entomologist*, has now completed its eleventh year, and has made a reputation for itself which is second to none in the same department of science; it has been regularly issued and has always been well filled with useful matter. The articles have been almost entirely original, and any new developments in Entomology have been promptly recorded in its pages.

The meeting of the Entomological Club of the American Association for the Advancement of Science, was held at Saratoga, commencing on the 26th of August. Our society was represented by the President, Mr. Wm. Saunders, and the Vice-President, Rev. C. J. S. Bethune, M.A.

It has been decided to exhibit our collection of Canadian insects at the Dominion Exhibition at Ottawa, and our collection of foreign ones at the Western Fair in London. The Ottawa collection is formed of the bulk of our Centennial display, so that those members who visit Ottawa, who have not before seen our collection, may be enabled to judge of its value.

Our branches in Montreal and London are still carrying on a successful work, and join the Parent Society in hailing the coming year as one of increased usefulness and success.

Submitted on behalf of the Council, by
JAS. H. BOWMAN,
Secretary-Treasurer.

Mr. Couper then read the report of the Montreal Branch, indicating very satisfactory progress; this was referred for publication.

The annual address of the President was next in order, after the reading of which a vote of thanks was tendered to him, both in the name of the Society and also in that of the Ottawa Field Naturalists' Club, for his exceedingly interesting and instructive address, and a copy was requested for publication in the Annual Report.

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

To the Members of the Entomological Society of Ontario:

GENTLEMEN,—Again it is my privilege as your retiring President to address you, to draw your attention to Entomological subjects, and more especially to the operations of the insect world about you, and to record the progress or decline of those noiseless disturbers of our peace—injurious insects.

The City of Ottawa being one of the great centres of our lumbering interest, it seems fitting that I should on this occasion call your particular attention to some of those insects most injurious to our pine forests. The losses occasioned by the destructive work of borers in pine trees, both before and after they are cut, are unfortunately too well known to those interested in the lumber trade, although the sufferers may not be familiar with the life histories of their enemies so as to be able to recognize them in the various stages of their existence. The lumberman suffers from the work of a number of destructive species, nearly all of which inflict their greatest injuries during the larval stage of their existence.

There are three families of beetles in which are included the greater number of our enemies in this department. I allude to the longicorns or long-horned beetles, *Cerambycidæ*; the serricorn or saw-horn beetles, *Buprestidæ*, and the cylindrical bark beetles, *Scolytidæ*. To go over this long series in detail would weary you. A brief sketch of the life history of a single example in each family will serve as representatives of the whole.

One of the most destructive of the species included in the *Cerambycidæ* is a large grey beetle with very long horns, known to Entomologists under the name of *Monohammus confusor*, and popularly in this district as the "Ottawa Cow." Where trees have become diseased from any cause, or where a fire has ravaged a pine forest and scorched and partially destroyed the timber, or where logs after being cut have been allowed to remain a season in the woods or in the mill yard—there these insects gather and soon multiply to a prodigious extent. The mature insect is over an inch in length; the antennæ of the male reaches the extraordinary length of from two to three inches, while those of the female are shorter. The female lays her eggs in the crevices of the bark, where the larvæ when hatched eat their way into the wood, burrowing extensive galleries through the solid timber; when mature they are large, white, almost cylindrical, footless grubs. They pass their chrysalis stage within their burrows, and the perfect insect on its escape eats its way out through the bark. There are about a dozen species in this family known to be destructive to pine.

Most of the insects belonging to the family *Buprestidæ* may be recognized by their brilliant metallic colours; they have very short antennæ which are notched on one side like the teeth of a saw, and are often hidden from view by being bent under the thorax. *Chalcophora liberta* is one of the most destructive to pine trees, and its history is very similar to that of the long-horned beetle just described, but the larva is of a different form, and has the anterior segments or rings of the body very large, reminding one of the appearance of a tadpole. The perfect insect is about three-quarters of an inch long, of a brassy or coppery hue, with the thorax and wing-covers deeply furrowed by irregular longitudinal depressions. Dr. Fitch enumerates twelve species belonging to this family which are known to be injurious to pine. Additional information in reference to these beetles may be found in an article contained in the last annual report of our Society, by Mr. J. Fletcher, of Ottawa.

The cylindrical bark beetles, *Scolytidæ*, are also a numerous family, eight species of which are known to attack pine. The boring Hylurgus, *Hylurgus terebrans*, is probably one of the commonest. This beetle is about a quarter of an inch long, of a chestnut red colour, thinly clothed with yellowish hairs, and is found during the month of May. The larva, which is a small yellowish white footless grub, bores winding passages in every direction in the inner layers of the bark of the tree, and also through the outer surface of the wood.

In some parts of our Province pines are greatly injured and sometimes killed by the attacks of a woolly bark louse, which covers parts of the trunk and branches with a white cottony secretion, under the protection of which myriads of tiny lice live, puncturing the bark with their sharp beaks and exhausting the trees by feeding upon the sap.

While we are mainly interested in the preservation of our mature forests, the future of our country demands that we shall not overlook the young growth on which the lumber supply fifty or a hundred years hence must largely depend, and which it should be the policy of our rulers to protect as far as possible. Most of the governments of Europe are now fully alive to the importance of this matter, and are annually spending large sums of money in establishing young forests. Two years ago I called your attention to an insect then recently discovered by Prof. A. R. Grote, of Buffalo, which was greatly injuring the terminal shoots of both the white and red pines in Western New York; it was the larva of a small moth, *Nephopteryx Zimmermani*, which fed under the bark, causing a free exudation of resinous matter from the wounds it made, followed usually by the death of the twigs infested. Since then it has been found over a much wider area than was at first anticipated, and I have no doubt but that it is to-day materially retarding the growth of young pine trees in many portions of our Province.

At a recent meeting of the Entomological Club of the American Association for the Advancement of Science (where our Society was represented by your President and Vice-President), Mr. S. H. Scudder, of Boston, submitted some observations on another lepidopterous insect which is injuring the young pines growing on the Island of Nantucket. It is a species of *Retinia* closely allied to *Retinia duplana* of Europe. The moth lays her eggs near the tips of the twigs, down which the young larvæ burrow, killing them outright, and thus stunting and almost destroying the trees. Prof. Comstock, of Washington, also referred to two other species of *Retinia* which he had observed injuring the pine trees in that city.

In addition to all these, there are a score or two of species of insects which are known to devour the leaves of the pines, damaging them in some instances very much. From the facts enumerated it is evident that we are suffering serious loss in all our lumbering districts from the silent workings of these insidious foes, and since in some measure to be fore-warned is to be fore-armed, I desire to call the special attention of those immediately concerned in the prosperity, present and future, of the lumbering interests of our country, to this important subject. Unfortunately it does not as yet seem to be within the power of man to do much directly towards restricting the operations of these enemies to our forests; yet this should not deter us from studying their habits and history, since an intimate acquaintance with these may result much more to our advantage than we now anticipate. A few trees, such as a belt, or a group planted for shelter or ornament, may be protected from the leaf and twig destroyers by syringing with a mixture of Paris Green and water in the proportion of a teaspoonful to a pail of water, and the bark lice may be killed by the use of alkaline washes applied with a brush or broom, and a timely application of the same will prevent the operations of the borers; but it is scarcely possible that such remedies can ever be applied over extended areas of forest. It is, however, gratifying to know that in addition to the numbers devoured by our insectivorous birds, almost every injurious species is in turn attacked to a greater or less extent by insect parasites of the most active habits, who seek out and destroy these pests with ceaseless diligence; were it not for these friendly insects the destructive species would be far more numerous individually than they now are.

The question as to how best to check the increase of destructive insects is of the greatest practical importance, and probably no insecticide has of late played so important a part in this connection as Paris Green, which is a compound of arsenic and copper, comparatively insoluble and a substance which seems admirably qualified for the destruction of insect life. Besides its special use as a potato-beetle killer, it can be successfully used to destroy any and every insect which eats the leaves of plants, shrubs or trees. So poisonous an agent should be handled with caution if accidents are to be prevented, and it is a matter of great regret that in consequence of carelessness in its use the lives of many valuable animals have been sacrificed, and occasionally even human lives have been imperilled or lost. From the ease with which it can be procured it has also been resorted to in several instances by those determined on suicide. These unfortunate occurrences are greatly to be deplored, and every possible precaution should be taken to avoid accidents. It is quite a common occurrence for painters, hardware dealers and general merchants to sell Paris Green and to send it out without label of any sort, and sometimes the parcel is very insecurely put up and packed with groceries and other articles for home use in the most indifferent manner. Such recklessness should not be permitted and no one should be allowed to sell any substance so dangerous unless it is properly labelled with the name of the article and the word "Poison" prominently attached; with such precautions generally adopted many accidents which now occur would be prevented. It has been urged by some that so many evils have attended the use of Paris Green that it does more harm than good, and that its use should be discontinued; but in this I am not prepared to concur, as I am satisfied that without it, unless some suitable substitute were found, the potato crop in many localities could not be preserved from destruction. If reasonable care is exercised and the powder be used mixed with water, there is no danger attending it, and its use in this manner in the proportion already mentioned of a teaspoonful to a pail of water and applied with a whisk, is not only safe but most economical.

For some years past experiments have been made with various other substances with the view of finding a substitute for Paris Green which would be less dangerous in the hands of the careless, and among them I believe none have been used with greater success than common blue vitriol or sulphate of copper, in solution in the proportion of about an ounce to a pail of water, and applied in the same manner as the Paris Green mixture. This article is worthy of, and will doubtless receive, a more extended trial, as its use under any circumstances would be attended with but little danger. For the destruction of household pests Insect Powder has lately attracted much attention, and is probably the most valuable agent we have for this purpose, and it is quite harmless to man and the higher animals. There are two sorts of this powder, known in commerce under the respective names of Persian and Dalmatian Insect Powder; the former is the powdered flowers of *Pyrethrum roseum*, the latter of *Pyrethrum cinnerariæ-folium*. The Dalmatian Powder is most highly esteemed. The powder is diffused through the atmosphere by means of a small bellows, or insect gun, and in a very short time it brings house-flies, cockroaches, etc., on their backs, and dusted among bed-clothing is equally effectual on noxious pests there. It does not at first kill the insects outright, but paralyzes them so that they are unable to use either legs or wings, and after remaining in this condition many hours and sometimes days, a solitary individual here and there will either wholly or partially recover, but the great bulk of them die.

A very active blue-bottle fly placed under the influence of the powder was brought on its back in one and a half minutes. After six minutes it performed some remarkable evolutions, throwing itself about in the most desperate manner by the aid of its wings, for by this time it had lost the use of its legs; in a few moments more it was quiet, but still able to move its legs, and this power it retained for two days, after which it was lost sight of. The same powder was applied to a full-grown grasshopper; immediate uneasiness was manifested, and within two minutes its hind legs were partially paralyzed so that they could not be used with much effect. The first symptoms were a general rubbing of the legs against each other and a peculiar backward movement of the body; in four minutes there was a trembling of the whole frame, while all the legs were so much affected that locomotion was very feeble. In six minutes the insect had lost all control over its limbs, and in nine minutes it was on its back, with no power to recover its natural position. A second patient manifested precisely similar symptoms, but was not affected quite so rapidly. Applied to house-flies in a room, some of them begin to fall powerless in two or three minutes; others will remain active several minutes longer, but manifest constant uneasiness, evidenced in unnatural movements of wings and legs, and a frequent thrusting out of the proboscis. Having operated in a room one day about noon, I swept up after a few minutes several hundred flies and put part of them in a tumbler covered with a small plate, and the remainder in a chip box which I carried in my pocket for the first day, where the flies would receive some warmth from the body. After five or six hours the box was opened, when several crawled out or flew with a very weak, short flight; these were evidently recovering; the others remained on their backs, many of them moving their legs now and then. At the same time those in the tumbler were looked at; all were on their backs, but still alive. In twenty-four hours afterwards those in the glass were in the same helpless condition, barely alive, while in the box three more had so far recovered as to be able to walk, and one of them could fly a little. The following day they were examined again and every one of those in the box were dead, while in the tumbler, out of 187, there were 22 alive, which number was reduced to three the following day; this small remnant survived two days longer, when all died.

In the use of Insect Powder on the green Aphis, which infests house plants, the same course was observed; the insects dropped from the plants as if paralyzed, and after a short time were incapable of locomotion. After two days they were found still alive, but in this instance there was no sign of recovery in any of them, and all died within two or three days afterwards, but whether from the direct effects of the powder or from starvation I was unable to decide.

When I addressed you last year I referred to a strange disease which had destroyed large numbers of that destructive pest, the Forest Tent Caterpillar, *Clisiocampa sylvatica*. After the disease had reached a certain stage the larvæ remained motionless, retaining their hold on fences and the trunks of trees; shortly, although in appearance they were quite natural, when touched they were found to be dead, and their bodies were so decayed as to burst with a very gentle handling. Subsequent observations convinced me that this was the result of a fungoid disease to which caterpillars, as well as some perfect insects, are very subject. A similar disease sometimes attacks the silk-worm and causes great devastation, and the common house-fly is liable every autumn to die from the effects of a fungus which multiplies with amazing rapidity within the fluids of the fly's body, soon destroys life, and forms a circle of luxuriant growth all around its victim. Examples of this may be found on the windows of almost every dwelling during the month of September. Some years ago a learned European professor claimed that he had proved the identity of this fungus with the common blue mould and also with that of yeast; and in proof used the fungus of the fly for the purpose of raising bread, and shewed that it was possible to brew beer with the common mould. The close relationship, if not the actual identity, of these three was thus established. Quite recently it has been proposed by Dr. Hagen, of Cambridge, Mass., to use a diluted solution of yeast in water with an atomizer as a means of destroying noxious caterpillars and other insects by introducing disease among them, and it seems quite likely that the use of this remedy may to some extent prove effectual.

The Cabbage Butterfly, *Pieris rapæ*, having pretty well colonized the northern portions of America, is still travelling southward. During the present season it has been reported as common in many localities in the State of Alabama, and has nearly reached the Gulf of Mexico; it seems as capable of adapting itself to extremes of heat as of cold. The Forest Tent Caterpillar, *Clisiocampa sylvatica*, which has been so very numerous and destructive in our neighbourhood for two years past, has almost disappeared. The Colorado Potato Beetle seems to have fairly established itself in several places in Europe, and if it proves as prolific there as here it will be rapidly disseminated. The Wheat Midge, *Cecidomyia tritici*, has appeared in the neighbourhood of Port Hope, Ont., but not to any alarming extent. The Plum Curculio, *Conotrachelus nenuphar*, has been common as usual, while reports have been received from several districts of the increasing prevalence of the Codling Worm, *Carpocapsa pomonella.*

Our journal, *The Canadian Entomologist* has been well sustained during the past year, and through the kindness of our esteemed contributors we have been enabled to present our readers with many original papers of great practical value. Mr. W. H. Edwards, of West Virginia, has continued his very useful and valuable papers on the life histories of our butterflies. Dr. Bailey, of Albany, N. Y., has given us an interesting description of the various stages of *Cossus Centerensis*, illustrated by an excellent lithographic plate. Many new species of insects have been described by Messrs. A. R. Grote, W. H. Edwards, V. T. Chambers, Prof. Fernald and others, besides which we have published a very large number of papers of general interest.

Among the more important recent contributions to our Entomological literature may be mentioned a new edition of the Catalogue of the Described Diptera of North America, by Baron Osten Sacken; the Coleoptera of Florida and Michigan, by John L. LeConte, M. D., and E. A. Schwarz; Report on the Insect and other Animal Forms of Caledonia Creek, New York, by J. A. Linter; the Coleoptera of the Alpine Regions of the Rocky Mountains, by John L. LeConte, M. D.; on the Collection of Insects made by Dr. Elliot Coues in Dakota and Montana—the Orthoptera by Cyrus Thomas, Hemiptera by P. R. Uhler, Lepidoptera by W. H. Edwards; Notice of the Butterflies Collected by Dr. Edward Palmer in Southern Utah and Northern Arizona, in 1877, by Samuel H. Scudder; and an account of some insects of unusual interest from the tertiary rocks of Colorado and Wyoming, by the same distinguished author. The elaborate and voluminous report of the U. S. Entomological Commission on the Rocky Mountain Locust, with maps and illustrations, issued in 1878, did not reach us in time to be noticed at our last annual meeting. It is a work which has involved great labour, and besides containing much that is new, covers the entire field of our knowledge in reference to this destructive pest. Prof. C. V. Riley, of Washington, has issued a special report on the Silk-worm, being a brief manual of instructions for the production of silk, with illustrations. Prof. A. R. Grote has written Preliminary Studies on the North American Pyralidæ, and Samuel H. Scudder a Century of Orthoptera. Several additional numbers of Edwards' magnificent work on North American Butterflies have appeared, with charming plates.

The members of the Entomological Commission of the United States are devoting their attention this year especially to the Hessian Fly, investigating its habits, preparing statistics of the losses occasioned by its attacks, and testing the various remedies which have been suggested for its destruction. In a circular issued in June last they solicit the co-operation of Entomologists, many of whom will, I trust, be able to render them efficient aid in this good work.

During the year, death has removed from our ranks three well known labourers in the Entomological field, Dr. Asa Fitch, late State Entomologist of New York; Dr. Hermann Loew, the eminent German Dipterist, who has done so much to advance our knowledge of American Diptera; and Frederick Smith, the renowned English Hymenopterist. Thus, year by year, we are called to mourn the loss of those whose names, for their works' sake, we revere. They have gone to their reward; we live to labour. Let us each endeavour to make the best possible use of the time and opportunities we have, however limited they may be, and dilligently and contentedly labour in the sphere in which God has placed us; prompted by pure motives, may we with earnest effort probe deep into the secrets of nature, and draw from thence treasures new, so that when we pass away, we may leave behind us some little lustre which may lend a light, however dim, to those who will fill our places.

I have the honour to be, very sincerely yours,
Wm. Saunders.

The election of officers then took place, resulting in the appointment of the following gentlemen:—

President.—W. Saunders, London.
Vice-President.—Jas. Fletcher, Ottawa.
Secretary-Treasurer.—Jas. H. Bowman, London.
Council.—Rev. C. J. S. Bethune, M.A., Port Hope; Wm. Couper, Montreal; J. M. Denton and E. B. Reed, London; R. V. Rogers, Kingston; G. J. Bowles, Montreal; and W. Harrington, Ottawa.
Editor of Entomologist.—W. Saunders.
Editing Committee.—Jas. Fletcher, G. J. Bowles and E. B. Reed,
Librarian.—W. E. Saunders, London.
Library Committee.—E. B. Reed, J. M. Denton, H. B. Bock, London, with the President, Librarian and Secretary.
Auditors.—Chas. Chapman and A. Puddicombe, London.

A short time was agreeably spent in asking and replying to queries in reference to insects and their habits, and in examining the collections of insects in the Museum, after which the meeting adjourned.

ANNUAL MEETING OF THE LONDON BRANCH.

The Annual Meeting of the London Branch of the Entomological Society of Ontario, was held on the evening of February 11th, 1879, at the residence of the President, Mr. J. M. Denton. The President occupied the chair.

The Secretary-Treasurer read his annual report, which was adopted. His report shewed that the finances of the Branch were in a satisfactory condition.

The election of officers than took place with the following results.
President.—J. M. Denton.
Vice-President.—A. Puddicombe.
Secretary-Treasurer.—W. E. Saunders.
Curator.—C. Chapman.
Council.—Messrs. H. B. Bock, E. B. Reed and W. Saunders.
Auditors.—H. B. Bock and Jas. H. Bowman.

Permission was asked by Mr. C. Chapman for the School of Design to use specimens of some of our large Butterflies and Moths as models for the drawing and painting classes, which was cheerfully granted.

Mr. Saunders gave an interesting account of his recent visit to Florida, and exhibited some of the insects obtained by him while there.

Mr. H. B. Bock kindly presented the Society with a number of specimens of Coleoptera from Germany.

Subsequently an hour or two was spent in social intercourse and participation in the many means for enjoyment provided by Mr. Denton for the members. After spending an exceedingly pleasant evening the meeting adjourned.

W. E. SAUNDERS,
Secretary-Treasurer.

MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Sixth Annual General Meeting of the Montreal Branch of the Entomological Society of Ontario was held at the residence of G. J. Bowles, Esq., on Tuesday the 3rd June, 1879, at 8 o'clock p.m.

Mr. Bowles read a paper entitled, "Some of the insects that frequent the orchard and garden, under what circumstances they increase unduly, what insects to spare, what to kill, and how to kill them, with other useful information," by the Rev. F. W. Fyles, corresponding member of the Natural History Society.

The annual report of the Secretary-Treasurer was then read and adopted. This report shewed that after meeting the current expenses of the year, there still remained a very fair balance on hand.

The proceedings were closed by the election of the following officers for the ensuing year:—

President, G. J. Bowles; *Vice-President*, H. H. Lyman; *Secretary and Treasurer*, Geo. H. Bowles; *Curator*, F. B. Caulfield; *Council*, Robert Jack, W. Couper and G. B. Pearson.

The meeting then adjourned.

G. H. BOWLES,
Secretary.

ANNUAL REPORT OF THE COUNCIL OF THE MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

In presenting their Sixth Annual Report, your Council have much pleasure in stating that the Society is still making satisfactory progress.

Eight very pleasant meetings have been held during the year, and besides the many interesting Entomological items recorded in the minutes of the Society, the following papers have been read before the members:—

1. "On the Larvæ of *Papilio Brevicauda* and *Pieris Borealis*, and the food plants."—W. Couper.
2. "On the May beetle, *Lachnosterna quercina*, and its parasites."—G. J. Bowles.
3. "Introductory notes on the *Ichneumonidæ*."—G. J. Bowles.
4. "Notes on *Phyciodes Harrisii* and *Nycteis*."—H. H. Lyman.
5. "On the Saw-flies."—G. J. Bowles.
6. "My Entomological trip to the Godbout River, 1878."—W. Couper.
7. "On the Insects of the Mammoth Cave" (selected).—Geo. H. Bowles.

The following books have been added to the Library:—

"Riley's Reports," 2, 4 and 5, making the set complete. The nine reports have been bound in three volumes, and form a very valuable addition to our library.

"Hentz's Spiders of the United States," with 21 plates.

"Sausser's Solitary Wasps of America," with 4 plates.

"*La Crysomele des Patates*," from the Department of Agriculture, with 1 plate.

"Report of the Entomological Society of Ontario, 1878."

"Reports of the Fruit Growers' Association of Montreal, 1877 and 1878."

Our order for books to the Naturalists' agency is still not quite filled, and a balance of about $10 remains in their hands.

Your Council would note that additions are still being made to the list of species in the "Montreal Catalogue," and would recommend the work to the members as one worthy of zealous prosecution.

In regard to the labours of the coming season, your Council feel glad to report that the members are beginning their collections with renewed vigour; and they trust that the next year's operations will show a great advance in the study of our fascinating science in Montreal.

The whole respectfully submitted,

Geo. Jno. Bowles,
President

Montreal, 3rd June, 1879.

MEETING OF THE ENTOMOLOGICAL CLUB OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Annual Meeting was held, as announced, on the 26th day of August, in the Town Hall, in Saratoga, N.Y. The first session began at 12.30 p.m., the President, J. A. Lintner, of Albany, in the chair. The following members were present during the several sessions: Dr. John L. LeConte, S. H. Scudder, C. V. Riley, A. R. Grote, C. H. Fernald, Dr. John G. Morris, Rev. C. J. S. Bethune, Wm. Saunders, J. H. Comstock, E. P. Austin, F. W. Putnam, B. P. Mann, H. F. Bassett, W. S. Barnard, D. S. Martin, E. L. Graef, Dr. J. S. Bailey and E. H. Pohlman.

The Secretary, Mr. B. P. Mann, read the minutes of the last meeting in St. Louis, Mo., after which the President delivered the following address:—

ANNUAL ADDRESS OF THE PRESIDENT.

Gentlemen:—In the remarks which I presented to the Club at our last annual meeting, a brief review was given of the progress in American Entomology within the preceding half century. It was shewn that within the last few years rapid progress had been made; that the study of insects had enlisted the labours of many earnest and successful workers, and given to them names honoured in science both at home and abroad; that many large and valuable collections had been accumulated—several of which contained so large a number of types that their preservation in the future was a matter demanding serious consideration; that the literature had become quite extensive; that much had been done in working out the life-histories of our species and presenting them to the public in their economic relations; and finally, that the importance of the study had at last been recognized here, as long ago it had been in Europe, by a Commission appointed by our General Government, for the investigation of some of the insect pests which were the occasion of serious pecuniary loss, poverty, and almost starvation in some portions of our country.

It affords me pleasure to be able to report, that the past year has shewn no diminution of interest or activity in our department, but that work in it is being prosecuted with an energy and with results fully up to any other department of Natural Science, if we except those to which Congress and several of our States are extending their liberal aid.

If fewer new species have been described during the year, we may find encouragement in the explanation that we are approaching the period, if not already reached, when a new species may not be claimed as the reward of every Entomological excursion. And indeed, there does not seem to be urgent need of descriptions of forms so very far in advance of some degree of knowledge of transformations, habits and relations to the vegetable world.

An evidence of increasing interest is to be found in the frequent inquiries made for instructions in collecting, apparatus for preparation, and books for study. While the first two requests can be promptly met, not so with the last. We are unable to place in the hands of the student the volumes which he requires for naming his collections. This cannot but be the occasion of discouragement to the beginner, and often the cause of diversion of earnest labour to other departments of Natural History. A great need of our science at the present is, monographs of the families prepared by specialists, in which descriptions of all the species shall be given (not simply referred to), and accompanied by such synoptical tables and illustrations as will enable the student readily to ascertain the names of any species which has been described.

At our last meeting I stated to you that the names of 281 persons are recorded in the last edition of the Naturalists' Directory who are making Entomology their study in North America, and that it was probable that a full list would extend the number to at least 350. It now appears that half the truth was not told. A list kept by the Secretary of the Cambridge Entomological Club, published in Psyche, vol. ii., p. 9 of Advertiser, accompanying the numbers for Sept.-Dec., 1878, contained at the close of last year the names of 762 Entomologists in the United States and Dominion of Canada. I am informed by the Secretary that the list at the present time, without having been subjected to a critical revision, contains 835 names.

As a record of the current literature of any science is virtually a record of the progress of that science, may I ask your attention to a brief notice of some of the publications of the year following our St. Louis meeting.

A work that might serve as a model in the illustration of insects in their relations to the plants upon which they feed or frequent, is one of the unique series by Mr. Glover of *Manuscript Notes from My Journal*, entitled, "Cotton, and the principal Insects frequenting or injuring the plant." In its twenty-two quarto plates, engraved on copper, is shown the cotton plant in every stage of development from the seed to the mature plant, and in its various conditions as resulting from insect attack or from disease. In association with these figures, twenty-four insects frequenting the plant are represented. Several of the species are illustrated in an agreeable prodigality, giving enlarged views of the egg, the larva at different stages of growth, the pupa, the cocoon, the perfect insect at rest and in flight, its under surface, enlargements of parts, and the more marked varieties of the larva and the imago. Although not so stated, it is believed that the edition of these Notes was no larger than the others of the series, and consequently, that only about fifty societies and individuals have been the fortunate recipients of a copy.

The Natural History of the Agricultural Ant of Texas is a volume of 208 pages and 24 plates, by H. C. McCook, treating at length of the habits, structure and architecture of this interesting insect. The histological details have been worked out from preparations made by Prof. J. G. Hunt.

A volume, upon which Baron Osten Sacken has been for a long time engaged, has recently been completed and published by the Smithsonian Institution. The *Catalogue of the Diptera of North America* prepared by this author and published in 1858 was simply a compilation of published names, not claiming synonymic accuracy. It contained 1,800 species, but many of the number were too imperfectly described for identification. The new Catalogue is of such merit as to deserve more than a passing mention. It is fully up to, and in itself materially advances, our knowledge of the Diptera of our country. Its author modestly regards it as only critical in part—so far as the families have been worked out into monographs, and as still remaining a mere list of reference to earlier writers, in those families which have not been studied, or in which the existing collections are to a great extent still unnamed, as in the *Culicidæ*, *Chironomidæ*, *Cenopidæ*, the group of *Muscidæ calypteræ*, and the section *Asilina*. Its critical character may be seen from the statement, that of the 102 species of *Tabanus* enumerated in the old Catalogue, only 36 have been adopted in this.

An admirable feature of this Catalogue is that a large proportion of the species which it records—over 2,000 carefully described and authoritatively labelled species—are contained in the Collections of the Museum of Comparative Zoology at Cambridge, fwhere every possible care is given to them, and where they are accessible to the student or comparison and study. Most of these are types of Loew and Osten Sacken, or their determinations.

The remarks of the author on synonymy, nomenclature and priority, seem to me to be most excellent and worthy of serious consideration. In an extended discussion of the merits of the descriptions of Diptera of the late Mr. Walker of the British Museum, he characterizes them as so extremely superficial—descriptive rather of the specimen than of the species, that in his opinion, they should be entitled to no claim for priority whenever they cannot be positively identified without an examination of the type specimen. Thus, of twenty-six species of Dolichopus described by him, not a single one could be recognized. The question suggests itself, to what extent might this rule be extended to descriptions in the other orders of insects by this author, and in general, to the writings of other authors.

In considering the number of Diptera, Osten Sacken believes, that rejecting those descriptions which will probably prove irrecognizable, the number of described Diptera of North America, north of Mexico, will hardly reach 2,500; that the undescribed material at present in collections, if worked up, would perhaps double the number; and that when the long neglected order shall have received the attention given to the Coleoptera, it will equal if not exceed the latter, numerically.

Reference at the present to studies in the Diptera, naturally suggests the great loss which Dipterology has sustained in the recent death—in April last—of the distinguished Prussian Dipterist, Dr. H. Loew, long known as one of the most eminent cultivators of this branch of Entomology. During the last twenty years he has been engaged in the study of North American Diptera, and at the request of the Smithsonian Institution he has prepared a series of monographs, three volumes of which (Parts i., ii. and iv.) have been published by that Institution. While his removal from his work at this stage of its progress, cannot but be deeply deplored, there is a consolation to be found in the knowledge that it is not to be wholly arrested, but that a worthy collaborator—Baron Osten Sacken—remains to conduct it to a completion, we hope, of the plan proposed.

The series of *Dimmock's Special Bibliographies*, now being published at Cambridge, Mass., will prove to be of eminent service to the student who desires to avail himself of the literature of our insects, so widely scattered through the various scientific and popular journals, government surveys, and other publications. Two numbers of the series have been issued—the first containing a complete list to date, it is believed, of the Entomological writings of Dr. John L. LeConte, and the second, those of Dr. George H. Horn. A third, of the writings of Mr. S. H. Scudder, is nearly completed. I regret that it has been thought necessary, in this series, to dispense wholly with the use of capitals in all scientific names, even in the family and ordinal divisions, and I believe that many of you will agree with me in claiming for the royalty of science exemption from conformity to an innovation based on mere convenience.

Prof. C. V. Riley and J. Monell have contributed to the Bulletin of the U. S. Geolog.-Geograph. Survey (vol. v., pp. 1-32) a paper entitled *Notes of the Aphididæ of the United States, with Descriptions of Species Occurring West of the Mississippi.* Part I contains extended biological notes on the Pemphiginæ, by Prof. Riley, and Part II., notes on Aphidinæ with descriptions of new species, by Mr. Monell. The paper, illustrated by two plates, is a valuable contribution to our knowledge of these exceedingly interesting insects.

A special Report from the Department of Agriculture, entitled, *The Silk-worm, being a brief Manual of Instruction for the Production of Silk*, has been prepared by Prof. Riley, and largely distributed by the Department, to meet the demand from various portions of the United States for information upon the important industry of silk-culture. The Manual is quite full in the natural history of the Silk-worm, in the methods of culture, and directions for reeling the cocoons. There seems no reason why this industry, properly fostered, may not be made to add materially to the productive resources of our country.

Abstracts of the papers presented by Prof. Riley at the St. Louis meeting of the American Association for the Advancement of Science, have been published in the Proceedings of the Society, and also in a separate pamphlet. Among these are *Notes on the Life-History of the Blister Beetles and on the Structure and Development of Hornia; on the Larval Characteristics of Corydalus and Chauliodes*, and *A New Source of Wealth to the United States* [Sericulture].

A *Century of Orthoptera*, commenced by Mr. S. H. Scudder in 1868, and continued at intervals in vols. 12-20 of Proc. Bost. Soc. Nat. Hist., has been completed during the present year by the publication of the last three decades, in vol. 20, op. cit. The species described pertain to the Gryllides, Locustariæ, Acridii and Forficulariæ. The several parts as originally published have been reprinted in a pamphlet of 84 pages. Mr. Scudder has also published (Psyche, vol. ii., p. 154) a short list of Orthoptera collected in Appalachicola.

Entomological Notes, No. vi., by Mr. Scudder, issued the past year, is mainly a reprint of papers upon the Orthoptera originally published in the preceding year. The accompanying index furnishes a ready means of reference to the species contained in the several papers.

In the Annual Report of the Chief of Engineers for 1878, Prof. Cyrus Thomas reports upon a small collection of Orthoptera made in the Explorations and Surveys of the San Juan region of Colorado. The same volume contains a report by Mr. H. Strecker, on the Hymenoptera, Lepidoptera and Coleoptera from the same region, in which several new species of Heterocera are described, and a few figured.

Of our Entomological serials, the CANADIAN ENTOMOLOGIST continues to sustain its high reputation, and to merit the contributory aid which it is receiving from nearly all of our American Entomologists, and from some of our European friends.

Psyche, the organ of the Cambridge Entomological Club, is near the completion of its second volume. With the commencement of its third volume such improvements are promised as will render it of still higher importance to every student of American Entomological literature.

The *Transactions of the American Entomological Society* have reached the seventh volume. Although the Society has become a section of the Academy of Natural Sciences of Philadelphia, it is proposed to continue the publication of the Transactions as at present as rapidly as the limited means available for the purpose will permit.

The *Bulletin of the Brooklyn Entomological Society* is continued. That of the Long Island Society has been discontinued.

The second volume of the *Butterflies of North America*, by Mr. W. H. Edwards, is in course of publication. It continues to maintain the high reputation which it has commanded, from its admirable delineations of forms and colouring, and the exceedingly interesting new biological details presented.

The North American Entomologist is a new candidate for favour and support, of which two numbers have appeared. It is a monthly periodical, published at Buffalo, N.Y., under the editorial charge of A. R. Grote. It purposes to present articles of value both to the specialist and the agriculturist on the subject of North American insects, together with notices of current entomological literature,

Descriptions of the Noctuidæ have been continued by Prof. A. R. Grote in contributions to the CANADIAN ENTOMOLOGIST and in the *North American Entomologist*. With a diminution in the number of new forms of Noctuæ presenting themselves, Mr. Grote has directed his attention to the Pyralidæ, and has published a paper in the Bull. U. S. Geolog.-Geograph. Survey (vol. iv., pp. 669-705), entitled, *A Preliminary Study of the North American Pyralidæ*, in which a number of new species are described, the species of Botis enumerated, and the venation given of certain genera of the Phycidæ. A supplement to this paper follows in the *North American Entomologist*, No. 2, pp. 9-12.

To the study of the Tortricidæ—a family which has received scarcely any attention in this country since the death of Mr. C. T. Robinson, Prof. C. H. Fernald, of Orono, Me., has been devoting special and earnest attention. He has been able to examine nearly all the material contained in the principal collections in this country, and during the past winter has visited the larger collections in Europe for their study and a comparison with our forms. In England, the Tortricidæ in the following collections were critically examined by him: those of the British Museum, of H. T. Stainton, R. McLachlan, C. J. Barrett and Lord Walsingham; and on the continent, the collections in Brussels, Berlin, Munich, Naples, of Prof. Zeller in Stettin, Dr. O. Staudinger, MM. Deyrolle and Ragenot and the Jardin des Plantes in Paris. The above amount of preliminary work should certainly enable Prof. Fernald, as is his hope, to present us with a rearrangement of this extensive family quite in advance of any heretofore proposed. Prof. Fernald has prepared a synonymical list of our North American species, which is nearly ready for publication.

The work of Mr. V. T. Chambers on the Tineidæ of the United States, has been vigorously prosecuted, as may be seen in his frequent publications in the CANADIAN ENTOMOLOGIST. His papers on *Tineina and their Food-plants, and Index to the Described Tineina of the United States and Canada* (Bull. U. S. Geolog.-Geograph. Surv., vol. iv., pp. 107-167), have been appreciatively received as very convenient for reference.

The comparatively small but difficult group of the Pterophoridæ has engaged the attention of Mr. Charles Fish, of Oldtown, Me., and his studies have already made him our best authority in these forms.

From the above references to special studies in several of the families of the Lepidoptera, it will be seen that this attractive Order gives every promise of soon occupying high vantage ground.

In the other Orders—it is quite unnecessary that I should refer in the Coleoptera to the labours of Drs. LeConte and Horn. You will know of their untiring work, which has made the field which they are so thoroughly working almost exclusively their own.

In the Diptera, Mr. C. P. Whitney has published descriptions of a few species of Tabanidæ.

Mr. W. H. Patton has communicated some descriptive papers on Hymenoptera to the CANADIAN ENTOMOLOGIST.

Mr. E. T. Cresson has published a catalogue of North American Apidæ, with descriptions of new species, comprising 108 pages of vol. vii. of the Trans. Amer. Entolog. Soc.

Some valuable lists of species collected in particular regions have been given us, which are of service in extending our knowledge of Geographical Distribution. Among these, in the Coleoptera, may be mentioned, a list by E. A. Schwarz of 1,457 Florida species (Proc. Amer. Philosoph. Soc., v. 17, pp. 353-472); of 1,246 species from the Lake Superior region by H. C. Hubbard and E. A. Schwarz; by the same, of 1,787 species from the lower Peninsula of Michigan (loc. cit., v. 17, pp. 593--666); by Dr. LeConte, of 220 species collected in the Rocky Mountains at an elevation of 6,000 feet and upwards (Bull. Geolog,-Geograph. Surv. Terr., v. 4, pp. 447-480); additions to Messrs. Austin and LeConte's Catalogue of the Coleoptera of Mt. Washington, of 89 species, extending the number to 319, by F. Gardiner, jr. (Psyche, v. 2, p. 211); 316 species from Wallace Co., Kansas, by F. H. Snow (Trans. Kans. Acad. Sci. vol. vi., pp. 61-70); and additions of 435 species to the Catalogue of Kansas Coleoptera, by E. A. Popenoe (ut. cit. pp. 77-86), increasing the number to 1,711.

In the Lepidoptera, Mr. C. E. Worthington furnishes a list of 229 species of Noctuidæ from the vicinity of Chicago, Ill., (Canad. Entomol., v. xi., p. 68); Mr. W. L. Devereaux, a shorter list of species taken in Wayne Co., N. Y. (ut. cit., p. 105); Prof. F. H. Snow, a list of 104 species collected in Colorado, by the Kansas University Scientific Expedition in 1876.

The valuable biological studies of Mr. W. H. Edwards have been continued with their wonted earnestness. Through the success attained by him in carrying a large number of species of butterflies from the egg through their transformations, he has secured their entire life-histories, several of which have been published during the past year, and others illustrated in the volume of the *Butterflies of North America*. Of the Satyridæ, the larva of which are so rarely met with that I may venture to say many members of this Club have not seen a living example, he has reared all of our Eastern species with the two exceptions of *Satyrus Pegale* and *Chionobas semidea*. The interesting experiments in producing change in the imago by the application of cold to the chrysalis have been continued and been duly recorded.

A large number of biological papers have been contributed to our Entomological journals. From those accessible to me at the time of writing I find contributions from the following:—C. J. S. Bethune, J. Boll, Robert Bunker, V. T. Chambers, A. J. Cook, Charles Dury, H. Edwards, W. H. Edwards, J. H. Emerton, G. H. French, H. A.

Hagen, E. C. Howe, D. S. Kellicott, J. L. LeConte, B. P. Mann, T. L. Mead, C. V. Riley, W. Saunders, C. G. Siewers, Emma A. Smith, F. H. Snow, C. E. Webster, O. S. Westcott, C. E. Worthington, and G. D. Zimmerman—a quite incomplete list of the contributors to this department.

Results of anatomical studies of insects have been published by Messrs. C. F. Gissler, J. D. Hyatt, E. L. Mark, and C. V. Riley.

It would be inexcusable in a notice of biological work to omit reference to what is being done in this direction at the Museum of Comparative Zoology at Cambridge. Under the hand of the eminent Curator of the Entomological Department, Dr. H. A. Hagen, a biological collection of insects has been brought together that is far in advance of any similar collection in the world. It was my privilege recently to give it a partial examination, and when I say that I know not how to express my high estimation of it, I give it but imperfect praise. No one, whose studies have prepared him for the appreciation of such a collection, can examine it without wondering when, where and how the material was obtained. As an illustration of the natural history of species in their several stages, architecture, depredations, food-plants, diseases, parasites, etc., it is difficult to see how its plan of arrangement can be improved. In consideration of its high value, it is very gratifying to see that such unusual means have been resorted to for its preservation, as, with a reasonable supervision and without the operation of other than the ordinary causes of destruction, will extend its benefits to our successors in coming centuries. In addition to the biological collection, two others have been arranged: the one comprising the insects of North America, and the other those of the world. Of the number of type specimens contained in these collections, there is not the time at present, nor is it the occasion, for more than simple mention. The student in American Entomology, who aims to be fully abreast of the most advanced progress in his line of study, cannot neglect the means of information which the Collections and Library of the Entomological Department at the Cambridge Museum offer him.

The published results of economic investigations during the year have been quite limited. In consideration of the exceeding importance of these studies, it is painful to have to record the fact of the issue of but one Annual Report of a State Entomologist—that of Cyrus Thomas. This second report of Dr. Thomas, forming the seventh in the series of the Illinois reports, is a volume of nearly 300 pages. In it Dr. Thomas discusses the depredations of some of the Orthoptera, Coleoptera and Hemiptera. Prof. G. H. French, Assistant Entomologist, presents brief descriptions of a large number of diurnal and nocturnal Lepidoptera and their larvæ, with notices of their habits, accompanied by analytical tables for their identification. Miss Emma A. Smith, special Assistant Entomologist, offers the results of original investigations in some species of special economic importance. The publication of this and the preceding Report, without, as is evident, the opportunity of the revision and correction of proof by the authors, is much to be regretted, as serious errors in the nomenclature and elsewhere have thereby been given extensive circulation.

The Annual Report of the Entomological Society of Ontario, making the ninth in the series, contains its usual amount of matter of interest to the Entomologist, and of value to the agriculturist and horticulturist.

Several articles treating of insect depredations have appeared in our scientific journals, which cannot now be referred to.

The United States Entomological Commission, continued by an appropriation by the last Congress of $10,000, is actively engaged in its second year's operations. In its investigations of the Rocky Mountain Locust, its labours have been almost entirely confined to that portion of country designated as the Permanent region, with a view of determining the limits of these permanent breeding grounds, and to obtain the requisite data for the preparation of a map, and a scheme to be recommended to the Government, by which the excessive multiplication of the species in that region, and the consequent migration therefrom, may be prevented. It is understood that the recommendation to the Government will be, that in connection with the authorities in British America, efforts be made to restrain the extensive prairie fires in autumn which are common to that region, and subsequently to burn them in the spring after the hatching of the young locusts. This plan is believed to be feasible, as the breeding grounds are not co-extensive with the so-called Permanent region, but are limited to the richer valleys, plateaus and river borders within it.

The Commission will also, it is understood, in its forthcoming report, recommend to the Government a scheme for a system of warning and prevention, through the aid of the mounted police patrol of the Dominion Government, and our signal bureau and military posts.

Having been favoured with a transcript of the subjects to be treated of in the forthcoming Second Report of the Commission, and the assignment of subjects to the respective members of the Commission, I have no hesitancy in giving assurance of a volume of unusual interest and value. It is to be hoped that Congress will not repeat the inexcusable blunder of ordering of it an edition by far too small to supply the demand, or for the accomplishment of a main object in its labourious preparation—the diffusion of the needed information among those to whom it could not fail of proving beneficial.

The Commission is also occupied with investigation of the Hessian-fly and the Chinch-bug—each of which are chargeable with annual injuries to the amount of several millions of dollars.

The investigation of the natural history and habits of the Cotton-worm, commenced by the Department of Agriculture last year, has by direction of Congress, been transferred to the Entomological Commission. Prof. Riley has been pursuing its study in Southern Texas and in the Gulf States, aided by special assistants, and it is believed that discoveries have recently been made which will reduce the cost of destroying the larvæ to perhaps a fourth of what it has hitherto been.

Among the special subjects of study which have claimed attention lately, an interesting one has been the pupation of butterflies. Observations made during the past year on the pupation of some of our butterflies have shown us that we have been at fault in accepting the account given of it by Reaumur over a century ago, and received and quoted by subsequent authors. The most interesting operation in the pupation of the suspensi butterflies is the withdrawal of the chrysalis from the larval skin, the casting off of the skin with its attachment by the terminal legs to a button of silk spun for the purpose by the larva, and the attachment and suspension of the chrysalis by its anal spine to the silk button. Reaumur represented it as accomplished by the chrysalis in its extensions and contractions grasping the larval skin between the segments, and by this means raising itself until it regained the button. Recently Mr. Osborne, an English Entomologist, discovered a membrane serving as a suspensory agent in the change to the pupal state, and for the first, questioned the account given by Reaumur. His observations were confirmed by those of Mr. W. H. Edwards, and followed up by additional observations on large numbers of Nymphalidæ and Danaidæ, some of which have been presented in the CANADIAN ENTOMOLOGIST. There seems to be no question of the existence of such a membrane, and that it consists of the portion of the larval skin lining the region of the rectum, caught upon two knobs conveniently placed for the purpose. Prof. Riley, in a communication to *Psyche* (vol. ii., p. 249) finds other means of chrysalis suspension—the principal one being the shed intestinal canal, and accessory ones, the tracheal vessels of the last pair of spiracles; these Prof. Riley regards as the principal agents in suspension. In opposition to this, Mr. Edwards considers these ligaments as of but little, if any, service, and finds the membrane to furnish all the requisite support. Additional observations are required to reconcile these different views.

The beds of fossil insects recently discovered in the Tertiaries of our western Territories are proving to be wonderfully rich in number of species and condition of preservation. From a single small basin exposed by a railway cut in the vicinity of Green River Station, Union Pacific Railroad, in Wyoming, Mr. S. H. Scudder in *Fossil Insects of the Green River Shales* (Bull. U. S. Geolog.-Geograp. Surv. Terr., iv., No. 4, pp. 747-776) enumerates eighty species, representing all the orders of the Insecta except Lepidoptera. An idea of the richness of these beds may be obtained from the statement, that a two hours' search was rewarded by the collection of fifty new species. We are glad to learn that Mr. Scudder is engaged upon a general work on our fossil insects, which will form one of the volumes of the quarto reports of the Hayden Survey—the beautiful typography and illustration of which causes us to regret the prospective speedy termination of the series. As the Tertiary Shales of the Rocky Mountain region give every promise of being richer in insect remains than any other country in the world, the material for this volume will be more ample than any other student in fossil entomology has been able to command.

For the evident omission of reference to much valuable work done during the period reviewed, I ask indulgence. The time that I had allotted to the preparation of my sketch was found, too late, to be quite insufficient for the extended bibliographical examinations required for even an approach to completeness. I offer it only as a partial sketch, and as such please accept it.

On motion, the thanks of the Club were tendered to the President for his able and interesting address, with the request that a copy be sent to the CANADIAN ENTOMOLOGIST for publication.

The Club next proceeded to consider the amendment to the Constitution proposed at the St. Louis meeting, and after much discussion, the amendment was adopted in the following form:—

1st—No resolution affecting important scientific questions shall be adopted at any meeting of the Club unless there shall be present at least seven members who shall have been enrolled at least one year previous to said meeting.

2nd—When any motion has been carried by the Club, such motion shall not be rescinded at any subsequent meeting unless there shall be present at least seven persons who shall have been enrolled as members one year or more previous to said meeting.

3rd—Five members shall constitute a quorum for the transaction of ordinary business.

The Secretary was instructed to draw up a list of members of the Club, to be embodied in the record of its proceedings, including all those who had been present at previous meetings.

The second meeting was held at 4:30 p.m., the President in the chair.

Mr. Grote exhibited specimens of *Pseudohasis eglanterina* sent him by Mr. James Behrens, of San Francisco, who had collected them on the top of Mount Shasta. These differed from the ordinary specimens in being almost entirely black on the upper side. Mr. Grote expressed the opinion that this variation was mainly due to the climatic influences to which they were subjected in this elevated situation.

Dr. J. G. Morris referred to the fact that certain Water Beetles carry with them when they dive a globule of air underneath their bodies, and asked for information as to what purpose it served. Mr. E. P. Austin said that this bubble was retained underneath by the stiff hairs along the abdomen, and as it was known that the air gradually disappeared if the insect remained long under water, it was supposed that the air was gradually inhaled by the insect, which was thus enabled to lengthen its stay under the water.

Mr. B. P. Mann presented a list of the Entomologists of North America, and requested the members to confer with him as to additions and corrections. Some beautiful examples of coloured drawings of *Noctuæ* by Mr. Pohlman, of Buffalo, were laid upon the table for the inspection of those present, and were much admired.

Mr. Scudder called the attention of the members to a lepidopterous insect which was doing much damage to the pines on the Island of Nantucket. Previous to the war of 1812 the island was well wooded, but during that struggle the occupants were reduced to such straits for fuel that they had burned every tree. For many years the island had remained in a barren state, but some time ago plantations of Pines were begun, and a broad belt of young trees of *Pinus rigida* from 10 to 20 feet high, with scrub Oaks, now cover a large part of the island. The success of this experiment is seriously threatened by the presence of the insect referred to, which is a Tortrix belonging to the genus *Retinia*, and closely allied to *duplana*, *sylvostrana* and *frustrana* of Europe. The larva affects the tip of each terminal bud and bores its way through this into the twig to the depth of two or three inches, killing the terminal leaves and thus preventing the trees from making any growth. The moth is double brooded, and has not been observed in that locality beyond the precincts of the island. Mr. Scudder also presented a plate with enlarged drawings of the insect and its work.

Mr. Comstock had met with the same insect on *P. inops*, and had found that the tips of the branches of the Pines were usually covered with a web. He had also found another species of *Retinia* infesting the twigs of *P. rigida*. This latter bores into the small twigs of the tree, from which exude masses of resin. The larva lives within the branch upon the wood, and before pupating forces its way through the mass to the outside.

Mr. Bassett had observed some fifteen years ago, about Waterbury, Conn., that the common White Pine (*Pinus strobus*) was greatly injured at the tips of the branches by *Pissodes Strobi*, but for the last ten years this pest had almost disappeared. Mr. Riley referred to another Tortrix affecting the Junipers on Long Island, *Dapsilia rutilana*, a European species recently imported.

Prof. Fernald stated that he had received from Oregon and Washington Territory, specimens of *Retinia duplana* and *sylvostrana* identical with the European forms, and further referred to the fact that in America the species of Tortricidæ are more abundant in the West than in the East.

Mr. Grote called the attention of the membersto the ravages of *Nephopteryx Zimmermani*, which he believed had inflicted more injury on young pines than any other insect; it is found throughout the northern and north-western parts of New York State. Mr. Grote laid particular stress on the fact that the European pines imported and sold by nurserymen are much infested, and desired to call public attention to this matter. With regard to the use of Paris Green as an insecticide, he thought that it was doubtful whether the injury caused by it was not greater than would occur from the Potato Beetle were it allowed to go unmolested; and instanced the loss of a stallion valued at $2,500, poisoned by Paris Green, and also referred to the frequent injuries to animals and man reported in the newspapers. This opinion was opposed by other members present, who stated that but for the use of Paris Green or some such poison it would be impossible in some sections of the country to grow potatoes at all.

Prof. Fernald referred to a Tortrix found in Maine, *Tortrix nigridia*, which had very much injured the pines there; he had collected a large number of the larvæ and chrysalids of this insect, and from them, besides the moths, had obtained many ichneumon parasites and also several hair snakes. Prof. Fernald embraced this opportunity of calling the attention of the members to the condition in which he had found the types of the Northern American Tortricide. Many of them were being destroyed by the verdigris formed by the corrosion of the pins on which they were mounted, and in some instances this verdigris has accumulated to such an extent as to burst the bodies of the insects. To avoid this difficulty he has used japanned pins, and found that when thus coated they remained free from corrosion.

Mr. Grote remarked that *Scoliopteryx libatrix* was very widely distributed in this country as well as in Europe, being found here from Hudson's Bay to the Southern States. He also referred to Mr. Grey's discovery that *Limenitis arthemis*, *disippus*, *ursula* and *proserpina* are connected by intermediate individuals, and that this indicated that they had not long been separated from a common stock, and expressed the opinion that *arthemis* was probably nearest the original form.

Mr. Lintner held that it was premature to conclude that the different species of *Limenitis* are identical until it could be proven positively by rearing the one supposed species from the eggs of the other.

Mr. Scudder exhibited a piece of a woody root which was represented as coming from the interglacial beds of clay near Toronto, Ontario. This root proves by microscopic examination to belong to a species of Juniper and is bored by an insect, probably a *Scolytus*, but one which differs materially in its habits from any known species now existing. Mr. Scudder also referred to the abundance of insect remains which he had found in the peat deposits on the Island of Nantucket; from one mass of about a cubic foot he had obtained 300 fragments of Coleoptera, among which were several which he had been unable to refer to any species now known to exist; a number of these specimens were shown to the members.

Mr. Austin exhibited specimens of a wasp, *Polistes metrica* Say, infested with parasites.

On motion the meeting was adjourned until 8 p.m.

EVENING SESSION.

Prof. Comstock exhibited specimens of a small Pyralid which is carnivorous, feeding in the larval state on the maple tree bark lice, under the cottony matter secreted by the lice. He had bred forty of the moths fed in this way.

Mr. Scudder drew attention to a very singular fossil, of which he had obtained about 100 specimens, somewhat resembling the larva of an insect, but yet quite different from anything hitherto known. His remarks were illustrated by a figure of the object. It consists of only six segments.

Mr. Barnard exhibited specimens of *Phymata erosa*, which has proved quite destructive to other insects; they have been known to destroy quite a number of *Pieris rapæ*. Mr. Barnard exhibited a number of specimens which had been caught on the burrs of the Burdock.

Prof. Riley stated that *Pieris rapæ* was now quite common in Alabama; it had been seen as far as Selma, but had not yet reached Mobile. Mr. Scudder remarked that it had been found in Savannah, Ga., two years ago.

Prof. Comstock had received specimens of the Colorado Potato Beetle, this year, from Manitoba, and thought that this was the farthest point north it has yet reached.

Mr. Saunders made some remarks in reference to the capture of insects by the flowers of a species of *Bidens*, probably *chrysanthemoides*; the insects which he had observed thus captured were Dipterous, all of whom had been caught by the mouth; some were found dead, others still living, but unable to withdraw their proboscis.

In reference to the flight of butterflies, Mr. Lintner spoke of the enormous flocks of *Vanessa cardui* which had been seen in Italy, Spain and Germany during the summer.

Mr. Grote referred to an undescribed insect for which he proposes the name of *Oiketicus Abbotti*; he had obtained the cases of this insect on the cotton plant in the South, but had not seen the imago until he had reared it. This species is figured by Abbot in unpublished plates in the British Museum; it is referred to also in Harris' Correspondence, edited by Scudder.

The election of officers then took place, with the following result:—

President.—S. H. Scudder.

Vice-President.—A. R. Grote.

Secretary.—B. P. Mann.

After some discussion it was agreed that in future it was desirable that the President and Vice-President hold office for one year only.

The meeting then adjourned until the afternoon of the following day.

WEDNESDAY AFTERNOON SESSION.

Dr. Morris mentioned an interesting case of retarded development which had come under his notice, where a specimen of *Papilio asterias* remained in the chrysalis state two years and a half before the imago appeared.

Mr. Lintner remarked that instances of retarded development were common among the Bombycidæ, and especially mentioned *cecropia*; it also occurs frequently among the Sphingidæ, where a specimen will pass over one season until the next in the chrysalis state; this has been supposed to be a natural provision for the perpetuation of the species.

Mr. Bassett inquired whether in such examples they were not uniformly females. Mr. Lintner stated that in his experience both sexes were retarded.

Prof. Martin exhibited transparent specimens of gum copal in which were imbedded Hymenopterous insects. He stated that copal is a fossil resin of the post-tertiary period obtained chiefly from Mazambique; that he had found in this resin about fifty species of insects, about one-third of which were Coleoptera, one-third Diptera and the other third of the remaining Orders; two of the latter were Lepidopterous, one a Geometer, and the other he thought belonged to Zygaenidæ.

Mr. Bethune mentioned that he had found the larvæ of the Colorado Potato Beetle eating the leaves of the common Milk-weed, *Asclepias.*

Mr. Barnard had also seen one of these larvæ feeding on Milk-weed, but in this instance the larva was lighter in colour than usual. Mr. Lintner remarked that it was unfortunate that the Potato Beetle would feed in the larval state on quite a number of different plants, and in the absence of vegetable food would sometimes feed on one another.

Mr. Saunders had observed this carnivorous propensity of the Potato Beetle larvæ on several occasions, and had seen the same among the Cut-worms, and in one or two instances among larvæ of the Lycaenidæ. Mr. Scudder had also observed similar habits. Prof. Comstock had noticed it especially in the Cotton-ball worm *Heliothis armigera.*

Mr. Lintner invited Prof. Comstock to give some details in reference to the present plans and operations connected with his department at Washington. Prof. Comstock stated that he was endeavouring to work up a biological collection of insects on such a scale and in such a manner as shall be a credit to the Government. He has a large number of breeding cages, and an assistant who devotes his whole time to the rearing and mounting of insects. Special attention has been paid this year to insects feeding on clover, and the collection now contains over fifty species known to be destructive to this valuable crop. Prof. Comstock asked the aid of all Entomologists and assured them that any insects sent him would be well taken care of.

Mr. Scudder urged that Entomologists should recognize the fact that it is of the utmost importance that a collection as complete as possible should be formed in Washington, and that it should assume a national character.

Mr. Barnard asked for some information as to the method of arrangement adopted in the collection referred to. Prof. Comstock stated that he arranged the insects in their usual order and place; with the insect, its usual food plant, and where it feeds on several or many plants, a memorandum is placed with such specimen containing a list of the plants; by this method much duplication is avoided.

Prof. Fernald was asked to give some explanations regarding his work on the Tortricidæ. He began the study of this group two years ago, commencing with those species found in Maine, but soon found that he could do nothing satisfactorily without taking in all those found throughout the United States and Canada. He has also found it necessary to study the European forms, and is now engaged in examining all these structurally, with the view, if possible, of improving their classification, and earnestly desires help from collectors in all parts of the country, especially in reference to the larvæ of the different species. He thinks that the character of the head, thoracic shield and anal plate will probably be of most value in separating the species.

Mr. Saunders reported that *Papilio cresphontes* had been found rather common both in the larval and perfect state in several parts of Ontario this season. Dr. Morris said that he had found *Papilio ajax* particularly local in its distribution, abounding in some localities, but very scarce in others.

Mr. Lintner stated that *Pholisora catullus* had not been found about Albany until three years ago, when a single specimen was taken; this year it is one of the commonest species in and about the city; its food plant is *Monarda punctata.*

Rev. C. J. S. Bethune referred to the great abundance of *Papilio philenor* one season, many years ago in the neighborhood of Hamilton, Ontario; since then he was not aware that it had ever been found common in any part of Ontario.

A question was asked by Mr. Grote as to whether any of the species of *Cucullia* ever come to sugar. In reply, Dr. Bailey stated that he had captured three species of *Cucullia* and ten species of *Plusia* at sugar. Recently, when sugaring in a certain locality, he was surprised to find a large numberof Noctuids on decomposing animal matter, especially some partially decomposed deer hides.

Mr. Grote reported having taken *Audela acronyctoides*; one male was captured this month at light. He thought that this was the first time it had been taken in New York State.

Mr. Saunders referred to the fact that in the location where he resided large numbers of the larvæ of *Clisiocampa sylvatica* had died from a fungoid disease, and asked whether any of the members had tried solution of yeast as an insect destroyer, as lately suggested by Dr. Hagen.

Prof. Comstock stated that he had fed several larvæ on leaves dipped in yeast, but so far the yeast-fed larvæ had thrived remarkably well; his experiments had only been continued but a short time, hence he was not prepared to give any definite opinion on this subject.

The meeting then adjourned.

On Friday afternoon the closing session of the Club was held.

Dr. Morris stated that an apiarian in his neighbourhood had been severely censured by some fruit-growers because his bees had pierced their peaches, grapes, etc., and destroyed the fruit; he asked whether the bees really were the original authors of the mischief, or whether they only attacked such fruit as had been previously pierced by birds, wasps and other insects. He knew that writers differed on this subject, and mentioned that Prof. Cook and Prof. Riley take opposite sides here.

Prof. Macloskie thought that the mandibles of bees were not strong enough to tear the outer covering of peaches or grapes. Prof. Comstock was of a different opinion. Prof. Riley remarked that in some articles which he had published in the *New York Tribune* he had proved that bees are the depredators, and made some further interesting statements on this subject.

Dr. LeConte spoke of the destruction of some of our valuable forest trees by various insects, and requested the members during the next year to collect facts and to report them at the next meeting, so that the nature of their depredations may become fully known and further remedies may be suggested.

Mr. Minot offered some very interesting remarks on the larvæ of a number of species of water insects, chiefly Dipterous, illustrated by many beautiful drawings of the larvæ highly magnified.

Mr. Lintner referred to the importance of the study of aquatic larvæ, regretting that so little was known of their habits, and hoped that Mr. Minot would continue his studies in this direction.

From aquatic larvæ the conversation turned in the direction of that tiny tormentor, the mosquito, and marvellous accounts of its abundance in certain localities, and the sufferings of man and beast from its bloodthirsty propensities, were related by Mr. Scudder, Dr. Morris and others.

Mr. Riley made some remarks on the Cotton Worm, and stated that he had bred nine distinct parasites which preyed on this insect.

The time for adjournment having arrived, the members, after referring to the great pleasure they had derived from the interesting sessions of the Club, unanimously expressed the hope that all present might meet again next year in Boston.

The following articles have been selected on account of their general interest from the pages of *The Canadian Entomologist*, where they have appeared during the past year as original contributions.

OBNOXIOUS PESTS—SUGGESTIONS RELATIVE TO THEIR DESTRUCTION.

BY DR. H. HAGEN, CAMBRIDGE, MASS.

The question how to check the ravages of obnoxious insects is a very important one, and I am very often asked for advice in special cases. While occupied with a close examination of the proposed remedies and looking through a large number of scientific tracts, some of them fell into my hands and induced me to study them again. The present communication is the result of those studies.

Somewhat more than twenty years ago the lower forms of some fungi attracted the attention of many students, and especially of Dr. Bail, of Prussia. The reports of his observations are scattered in different periodicals, and the final result of my study of those reports was the conviction that a remedy for insect pests, offering several prominent advantages, could be found in the easy application of the yeast fungus. Further, that this remedy could be used probably against the famous Coloradó grasshopper, for the destruction of which the Government has appointed a commission appropriated with $75,000; also, that the remedy could be tried in an easy way against the obnoxious hairy caterpillars, against the potato bugs, and last, but not least, in every greenhouse against leaf lice and similar pests.

Dr. Bail asserts that he has proved by many skilful experiments that four species of microscopical fungi are merely different developments of the same species. One of them, the fungus of the common house-fly, is the vexation of every housekeeper. The dead flies stick in the fall firmly to the windows, or anywhere else, and are covered by a white mould not easy to be removed. The second is the common mould, known to everybody and easily to be produced on vegetable matter in a damp place. The third is the yeast fungus, a microscopical species, and the basis of the work done by yeast of fermentation. The fourth is a small water plant, known only to professional botanists. Dr. Bail contends that the spores of the fungus of the house-fly develop in water in this last species, out of water in mould, and that the seeds of mould are transformed in the mash tub into yeast fungus.

The experiments made by Dr. Bail cover a period of more than a dozen years, since the numerous objections which were made against his results induced him to repeat again and again his experiments in different ways. I am obliged to state that even now prominent botanists do not accept Dr. Bail's views, which he maintains to be true and to be corroborated by new and sure experiments. This question, important as it may be for botanists, is without any influence regarding my proposition, as Dr. Bail has proved that mould sowed on mash produces fermentation and the formation of a yeast-fungus, which kills insects as well as the fungus of the house-fly. I was present at the lectures of Dr. Bail before the association of naturalists, in 1861, which were illustrated by the exhibition of mould grown on mash, on which the fungus of the house-fly had been sown, and by a keg of beer brewed from such mash, and by a cake baked with this yeast. Both productions were declared perfect by all who tasted them —an experiment in which I did not feel obliged myself to join, as both are to be had prepared without the fungus of the house-fly.

In a later communication Dr. Bail states that the use of mould has been the secret in brewing formerly certain kinds of a strong and well-reputed beer.

For the so-called jopenbier in Danzig the mash was not used before the forests of mould grown on its surface had sunk to the bottom—or, in other words, till the spores of the mould were sown by themselves on the mash.

Dr. Bail has proved by numerous experiments that healthy insects brought in contact with mash and fed with it are directly infested by the spores of the fungus with fatal consequence. These facts, not belonging strictly to the main part of his experiments, were observed first by chance and later on purpose. The most different insects, flies, mosquitoes, caterpillars, showed all the same results. The experiments were made in such a delicate manner that a small drop of blood taken with an oculist's needle from the abdomen of a house-fly left the animal so far intact that the same operation could be repeated in two days again. Both drops examined with the microscope proved to be filled with spores of fungus.

More to the point are epizootics produced by this fungus and observed on insects in the open air.

A really pestilential epizootic of the common dung-fly was observed in 1867. Not only those, but many other insects, died in the same locality and in the same manner; also other species of flies and gnats, the caterpillars of moths and of Phalænids, and the common hairy caterpillars of a moth which is very nearly related to the famous hairy caterpillar of the Boston Common. Of some species the destruction was so complete that the next year they were very rare. During those years the caterpillars of two species of moths had destroyed pine forests belonging to the State and valued at several millions, and a larger calamity was imminent, when suddenly all caterpillars died from the same fungus.

Similar observations have been made in other places in Europe and here. Mr. Trouvelot formerly began in Medford, Mass., the raising of the Polyphemus moth for silk, and was successful enough to get a prize in the Paris Exhibition of 1867. Unfortunately he brought home from Paris eggs of another species from China, and purported to be superior for silk-raising in the open air. Those eggs proved to be infested by fungus, and the caterpillars hatched from them died, but not those alone. All caterpillars of the Polyphemus moth became infested, and even most of the other indigenous species living on the twelve acres of shrub land which Mr. Trouvelot utilized for this purpose, died rapidly. After two years of a similar calamity, Mr. Trouvelot was obliged to stop his experiments, which might have developed, perhaps, a new source of wealth for this country. A similar pest of an indigenous species of moth stopped only last year the interesting observations of Mr. Siewers in Newport, Kentucky.

The common silkworm in Europe has been in recent times extensively affected by a sickness called muscardine, which is also the consequence of a fungus. Similar fatal epizootics have been observed on the honey bee, and in Brazil several years ago nearly all the bees died from this cause. In Entomological journals are reported fatal epizootics of leaf lice, of grasshoppers, of the cabbage butterfly and of the currant worm, both imported here only a few years ago, and both very obnoxious.

Considering those facts, which are doubtless true, and considering the easy way in which the poisonous fungus can always and everywhere be procured and adhibited, I believe that I should be justified in proposing to make a trial of it against insect calamities. Nature uses always to attain its purposes the most simple and the most effectual ways; therefore it is always the safest way to follow nature.

Beer mash or diluted yeast should be applied either with a syringe or with a sprinkler; and the fact that infested insects poison others with which they come in contact will be a great help. Of course it will be impossible to destroy all insects, but a certain limit to calamities could be attained, and I think that is all that could reasonably be expected. In greenhouses the result would probably justify very well a trial, and on currant worms and potato bugs the experiment would not be a difficult one, as the larvæ of both insects live upon the leaves, which can easily be sprinkled. But it seems to me more important to make the trial with the Colorado grasshopper. I should recommend to infest the newly-hatched brood, which live always together in great numbers, and I should recommend also to bring the poison, if possible, in contact with the eggs in the egg-holes, to arrive at the same results, which were so fatal to Mr. Trouvelot's silk-raising. After all, the remedy proposed is very cheap, is everywhere to be had or easily to be prepared, has the great advantage of not being obnoxious to man or domestic animals, and if successful would be really a benefit to mankind. Nevertheless, I should not be astonished at all if the first trial with this remedy would not be very successful, even a failure. The quantity to be applied and the manner of the application can only be known by experiment, but I am sure that it will not be difficult to find out the right method. I myself have more confidence in the proposed remedy, since it is neither an hypothesis nor a guess-work, but simply the application of true and well-observed facts. I hear the question—When all this has been known for so long a time, why was it not used long ago? But is that not true for many, not to say for all, discoveries? Most of them are like the famous Columbus egg.

A SUCCESSFUL MOTH-TRAP.

BY O. S. WESTCOTT, RACINE, WIS.

Many attempts have been made to devise something by means of which to capture the Noctuidæ, but the results have been usually so meagre that the contrivances have been abandoned in disgust. I have been using a contrivance this season which will really abundantly repay one for the trifling trouble and expense involved in its construction. It consists first of a gallon glass jar, heavily charged with cyanide of potassium. To the top of this is fitted a funnel. the spreading mouth of which opens at right angles to the axis of the poisoned jar. The lower end of the funnel is four or five inches below the mouth of the jar and has an opening three inches in diameter, the funnel mouth being twelve or thirteen inches across. Opposite the mouth of the funnel, and on the opposite side of the jar, is soldered to the funnel a sheet of tin so bent as to thoroughly enclose a lamp. The lamp is supported by a piece of tin hinged to the outer edge of this projection. The lamp being placed in position, the tin support is made to rest upon the projecting part of the jar below its neck. Immediately in front of the light is placed a sheet of mica. The whole contrivance is placed within a tight wooden box, and a tin flap is also arranged above the lamp chimney as a precaution against an undesired conflagration.

The moth attracted by the light, flies into the mouth of the funnel, is stopped by the mica, and after fluttering a very short time, is so far overcome by the fumes of the potassium as to fall within the poisoned jar, whence it cannot emerge. A projecting lip of an inch or so in height is soldered to the lower edge of the mouth of the funnel in such a way as to catch any insect that falls outside the mouth of the jar. It thus is most likely to return to the light. I have taken with this contrivance hundreds of Noctuidæ and Coleoptera, among the former many things—especially among the Tineidæ—entirely new to my cabinet.

A CHEAP ENTOMOLOGICAL CABINET.

BY W. H. HARRINGTON, OTTAWA, ONT.

I have recently been looking over the back volumes of the *Entomologist*, and have found them, as I do the later numbers, very interesting and instructive reading. Among other valuable items, I have noticed suggestions regarding the construction of cheap cases for holding specimens, and as the question of expense is always an important one especially to young collectors, I will, if you can spare me space, briefly describe the style of cabinet I am now using, and which has been adopted by one of my friends.

Among the substitutes for cork mentioned by Packard (in his Guide to the Study of Insects) are thin frames covered on each side with paper and fitted into the bottom of drawers in a cabinet. Now I have gone a step farther, and discarding the drawers entirely, have adopted the frames and adapted them to a cabinet without drawers. This cabinet can be made of any size and be divided by upright partitions to suit the taste of the owner, and the frames can run in grooves made in the sides and partitions before it is put together, or between movable strips tacked or screwed in afterward at suitable distances, say two inches. The one I now use (a small one made as an experiment) is three feet two inches wide inside, with two partitions, so that there are three spaces each one foot in width. It is fifteen inches deep and two feet high. Placing the frames two inches apart gives me twelve in each section, or thirty-six in all, and as each has a surface of twelve by fifteen inches, I have an aggregate expanse of thirty-six square feet. The advantages claimed for this cabinet are its lesser weight and expense. It is easily handled and can stand pretty rough usage without fear of damaging specimens, as the pins are firmly held, and the frames, running in grooves or between strips, cannot stir when the door shuts close against them. It does away with the expense of drawers, the cork alone for which (thirty-six feet at 18 cents per foot) would be $6.48. The frames constructed of thin stuff (say quarter-inch) cost at the most five cents each, and suitable stiff cartridge paper is very cheap. If the frames are made slightly smaller than those mentioned one sheet will cover both sides of two frames. The paper is put on when damp, but should not be too wet. The frames can be easily re-papered if needful, and if the sections are made of equal width, they will all be interchangeable, which will be found a great convenience.

This manner of keeping specimens will, I think, be particularly useful to collectors of Coleoptera. I send this, feeling that each member of the Society should contribute his mite of experience and knowledge for the benefit of his fellow-workers.

NOTES ON A WINTER HOLIDAY.

B. W. SAUNDERS, LONDON, ONT.

During a recent holiday, while on a trip South, I spent a day among the Entomologists at Albany, N.Y. To say that it was a pleasant day, an *exceedingly enjoyable* day, would convey but a faint idea of the pleasures there experienced. Arriving early in the morning, I made my way to the State Museum of Natural History, where under the guidance of Messrs. Lintner, Meske and Hill, three veteran Entomologists, I had the pleasure of inspecting the countless rarities contained in the collections of Lepidoptera made by those gentlemen in this vicinity. I have seen many collections in the course of my wanderings, but for multiplicity of species, full series of rarities and matchless perfection of individual specimens, it had never before been my pleasure to witness anything that would compare with the valued stores contained in the cabinets of these enthusiastic collectors at Albany; and without fear of contradiction, it may be said that the Entomologists resident there have contributed more towards our knowledge of the Lepidoptera native to the northern portions of America, than any other equal number of collectors in the country. The enthusiasm they have long maintained and their indomitable perseverance have enabled them to overcome almost every obstacle and accumulate such wonderful series of specimens, especially by night captures at sugar, as no less favoured Entomologist could look over without feelings almost akin to envy. After one had seen scores upon scores of individuals of some rare Noctuid, which in one's own collection had perhaps long been represented by a treasured fragment, the question would frequently rise as to whether *anything* in this line be rare in the neighbourhood of Albany.

During the day I was also privileged to see the magnificent series of Catocalas in the collection of Dr. Jas. H. Bailey, and one could only regret that the day was too short to do any sort of justice to the mass of material to be inspected. After labouring busily from early morn until late at night, we parted at the railway station, with the most pleasant recollections of a day happily spent amidst old and and newly-found Entomological friends.

On reaching Washington, Nov'r 23, a brief visit was paid to the Entomological rooms, in the Department of Agriculture, where I had expected to find my esteemed friend, Prof. C. V. Riley, but unfortunately business had called him away from home. Through the kindness of Messrs. Pergande and Howard I was shown very many things of interest, especially in the way of insects in their earlier stages, both living in breeding cages and preserved as blown larvae, and in this way a very pleasant and instructive hour or two was spent. It was a source of grief to learn from our good friend, Chas. R. Dodge, that "Field and Forest" was about to be discontinued for want of sufficient support. This valued periodical has done good service in the cause of Natural Science, awakening an interest in this direction in many minds, and in its decease we have lost a valuable aid. It gave me much pleasure to find that veteran Entomologist, Prof. T. Glover, with health almost restored, busily engaged in his Entomological work. Through the affable kindness of Dr. T. V. Hayden, I was shown through the Department of the Interior, that great national laboratory from whence has issued so many works invaluable to the naturalist in every field of labour. After lingering long among the many interesting objects which claimed attention, I returned laden with useful works and pamphlets on subjects relating to Entomology, deeply impressed with the important work here carried on by a great and progressive nation in the interests of science; and with very pleasant recollections of the great personal kindness shown me by the worthy and distinguished head of this most useful branch of the national service.

The Smithsonian Institution was also visited, with its immense collections and innumerable objects of interest, and through the kindness and liberality of the Secretary, some recent and valuable works on Entomology and kindred subjects were secured for our Society's library.

Passing through Virginia, the Carolinas and Georgia, we landed in Fernandina, Florida, with its historic surroundings, on the 30th day of November, where everything assumed a tropical aspect, the landscape dotted with palms, orange trees, magnolias, live-oaks, and other evergreen trees, and the air so balmy as to at once suggest thoughts of butterfly nets and collecting bottles. Of the latter a supply was at hand, bnt not expecting to meet with anything on the wing, insect nets were left folded away in their wintry home. Many logs and chips were turned over in search of insect life, but very little was found. Subsequently, while wandering about in Jacksonville, I saw several butterflies on the wing, most of them unfamiliar; that charming yellow *Callidryas eubule*, was recognized as it floated about among the beautiful roses, jessamines, poinsettas and other flowers in the gardens, and one longed for a net that he might cultivate a closer acquaintance with this and some of the other interesting species. An old friend, *Danais archippus*, was frequently met with, and reminded me of summer at home. Florida, however, is very poor in insects at this season of the year, but as summer approaches it is in many parts a paradise for the collector. During a week spent in this land of flowers I travelled over 800 miles along its rivers and railways, seeing much of its characteristic scenery, the most southerly point touched being Leesburgh, on Lake Griffin, a little south of the 29th degree of latitude and 300 miles south of Jacksonville, by tortuous river travel. Here butterflies were more abundant, and having landed with a very pleasant party in an orange grove, amidst half a million of oranges on 2,500 large bearing trees, one was puzzled what to do first. The oranges were tempting, but the sight of beautiful specimens of *Agraulis vanillæ*, *D. berenice*, with charming *Heliconias*, *Theclas*, etc., was still more overpowering, and with hat in hand, the butterflies were vigorously pursued until several specimens had been secured, but with such imperfect means of capture at hand, the beautiful insects were battered and torn, and ones clothing having become covered with malignant burs collected in the chase, it was thought best under the circumstances—the first burst of enthusiasm being over—to devote more particular attention to the orange question.

While vigorously consuming oranges, enquiries were made as to whether the trees or fruit were subject to insect enemies. Beyond occasional specimens of the larva of *Papilio Cresphontes*, I could not learn of any caterpillar which consumed the leaves, and the only insect which seemed to trouble the orange growers at all was a species of Coccus —*Aspidiotus citricola*—which attacks the bark and foliage of both the orange and lemon trees, and occasionally, if very numerous, gives the tree a sickly appearance. But such an effect was rare, and one could not help feeling astonished at the luxuriant and vigorous growth of the average orange grove and the symmetry and beauty of the trees laden with their golden fruit, in soil, in most instances, so poor that one wondered where the nourishment came from. In our course up and down the Ocklawaha River, where the trees are everywhere clothed with the beautiful Florida moss, *Tillandsia usneoides*, and the swampy margins decked with brilliant asters and other composite flowers, many Neuropterous insects were seen on the wing, but none were captured; indeed, the catching of an insect seemed insignificant work in the midst of the excitement attendant on the shooting of alligators, herons, ducks and other large game, and at the close of the week there were very few spoils wherewith to grace the Entomological cabinet. Now, a few days later, amidst frosts and snow, the novel recollection of the recent heated butterfly chase, the cooling off under the shade of orange trees, imbibing the sweet rich juice of the fully-ripened fruit, and the additional novelty of a sunburnt brow, all in the midst of the month of December, are things not soon to be forgotten.

THE CLOVER-SEED FLY—A NEW INSECT PEST.

BY J. A. LINTNER, N. Y. STATE MUSEUM NAT. HIST., ALBANY.

In the summer of 1877, my attention was called to some "worms" which had been discovered in the heads of red clover *(Trifolium pratense)*, and were said to be preying upon the seeds. They were found to be minute maggot-like creatures, hidden within the seed-pods and entirely destroying the seeds which they attacked. Numbers of them were subsequently detected in the examination of heads of clover taken from several localities in the vicinity of Albany, and in Warren County, N. Y. I was unable at the time to refer the insect to any described species, or to find any record of a similar depredation on clover seeds in this country or in Europe.

The following season additional examples of infested clover heads were submitted to me, which had been sent from Mr. George W. Hoffman, Presiden tof the New York State Agricultural Society, from Elmira, N. Y. A number of the larvæ were obtained from these heads, and their careful examination enabled me to refer them to the Cecidomyidæ—of a species probably closely related to the well-known wheat-midge, *Cecidomyia destructor*. Several of the larvæ were preserved in alcohol, and the larger number placed in a pot of damp sand, in which they speedily buried themselves for their transformation.

At the annual meeting of the N. Y. State Agricultural Society, in this city, in January last, in a paper presented to the Society on some injurious insects observed during the past year, I gave an account of this new depredator upon an important crop, and described its larva as follows:

Cecidomyia leguminicola, n. sp.—Head subacute, subtriangular, slightly rounded laterally on its posterior half, giving that portion a subquadrangular form; a short cylindrical horny ? process at its tip, and two longer antennal processes, cylindrical, tapering apically. Body eriptical, moderately constricted at the joints, flattened on the sides, rather rounded behind, delicately shagreened, laterally at about the middle of each segment, a short fleshy papilliform process, with two short bristles of unequal length near the posterior of the segment; posterior segment bilobed, each lobe armed with two short fleshy ? processes, of which the outer is the longer; "breast-bone" of a pale yellowish colour, its projecting end divided into two rather blunt, laterally rounded, points. A dorsal row of processes similar to the lateral ones is suspected, but was not definitely made out. Colour of the living larvæ; pinkish, approaching orange; length, 0.08 of an inch.

The reading of the paper elicited the information that the insect had committed serious depredation upon clover-seed in Tompkins, Seneca and other counties in Western New York, during the past year. In Seneca County, fields of clover which had been kept for seed, proved to be not worth the cutting. It was also stated that a worm similar to those in the heads had been discovered preying upon the roots, but these are probably the same larvæ, which having matured, had left the heads for their pupation in the ground, where the Cecidomyidæ larvæ frequently remain unaltered for a considerable length of time.

The extent of the ravages throughout our country of this newly discovered insect, which promises to be of considerable economic importance, will be an interesting subject of inquiry for the ensuing summer; and the interesting question also arises, now that its hidden covert has been detected, will the species also be discovered in Europe, whence the red clover was introduced in this country.

I have been successful in obtaining examples of the imago of *Cecid. leguminicola.* Anticipating failure (since realized) in my efforts to rear it from the larvæ obtained by me last year, I applied, in May last, to Mr. R. J. Swan, of Geneva, N. Y., who at the annual meeting of the N. Y. State Agricultural Society, in January, had spoken of the occurrence in very large numbers of the larvæ in a clover field upon his farm, requesting that some of the surface soil from the field might be collected and forwarded to me. A small box of the earth (containing also some of the clover roots) of about six inches cube, was received by me on the 2nd of June, and spread out in a glass-covered case. On the following morning a male and female were found in the box. Additional examples were disclosed from the earth—about twenty-five in all—from that time to the 27th of June, since when none have been obtained. They had undoubtedly commenced to emerge during the month of May.

Marked features of the species, which will serve in its recognition, are the genitalia of the male, which are quite broad, projected on a pedicel, and arranged in an extended pair of clasping organs; and the long jointed ovipositor of the female, of about twice the length of the abdomen.

The antennæ of the Cecidomyiæ afford perhaps the best features for determination of species. The following description of the antennæ of the male of *C. leguminicola* was drawn from fresh specimens just after death:

Number of joints seventeen in all—the basal one coloured and short, the next one black, short and naked, followed by fifteen verticillate ones. Joints on penduncles as long as the joints, subcylindrical with rounded ends, about one-half longer than broad, rather thickly verticillate; the longest hairs nearly three times as long as the joints, and projected at nearly right angles to them; the shorter hairs about equal in length to the joints, some of which curve upward and have their tips nearly in the plane of the succeeding joint; joints regularly and gradually diminishing in size to the terminal one, which is about but one-half the size of the penultimate one, and of an ovate form.

The wings are clothed with numerous short, curved, blackish hairs, which give them a dusky appearance; ciliæ paler, long. The abdomen is fuscous, marked on each segment dorsally with black hairs forming a segment of a circle having the curve in front. The thorax is black above, clothed with rather long hairs.

The insect is in all probability quite generally distributed throughout the State of New York, and will be found in adjoining States. On the 1st of July, examples of the larvæ were obtained from clover heads gathered by me on Mount Equinox, Vermont, at an elevation of 2,500 feet above tide. On July 5th, although a late period for the larvæ, mature specimens were taken from clover growing within the city of Albany, from the sidewalk of Western Avenue. The only example of the fly which has up to the present, so far as my knowledge extends, been taken at large, was captured on the Hudson River, in the vicinity of Castleton, on the 16th of the present month (July), by Mr. Dempster A. Lansingh, of Albany. The keen eye that could detect so minute an object on the crowded deck of an excursion boat, deserves to be trained for use in entomological science.

From information kindly communicated to me by Prof. Wm. H. Brewer, of Yale College, New Haven, Conn., it is very probable that the existence of this clover pest was known at least thirty years ago. He writes as follows:

"My father, Henry Brewer, of Enfield Center, Tompkins Co., N. Y., was an enthusiastic grower of clover and clover-seed as far back as I can remember. Many years ago—how long, I cannot definitely say, but certainly before 1848, it was known to us that an insect attacked the clover, which hatched out a fly. Our belief then was that the larva existed *within the seed*. On two occasions I hatched out the flies and sent them by mail to Albany, to the Entomologist there—once before 1848, and once later, somewhere between 1851 and 1855.' The fly was very small and very slender, but having been found so many years ago, that is all the recollection I have of it. The clover heads were not affected externally by its presence."

There cannot be much doubt but that the above insect is identical with the little midge which has so recently commanded our attention, as the result of its multiplication, or, as is more probable, from a period of its unusual abundance. Accepting their identity, it is quite interesting that the first notice of the species, so far as known, comes from a county which is believed to be suffering more from its depredations, at the present time than any other portion of the State.

From the July number of the *American Agriculturist*, I learn, for the first time, that Prof. Riley has been engaged in investigations on this interesting insect. The article is drawn from a conversation with Prof. R., and in part from a communication by him a short time ago to the *N. Y. Tribune.* It contains a notice of the depredations, transformations and appearances of the midge, and is accompanied by excellent figures of the male and female with enlargements of parts, which will be of great service in its identification.

ON THE NEW CARPET BUG.

BY DR. HAGEN, CAMBRIDGE, MASS.

(The accompanying figure 1 represents this insect in its various stages: *a* the larva, *b* the skin of the larva, *c* the pupa and *d* the perfect beetle. This cut appeared in our last "Annual Report," but as the insect is being rapidly disseminated, we reproduce the figure here, so that all our readers may become familiar with its appearance. W.S.)

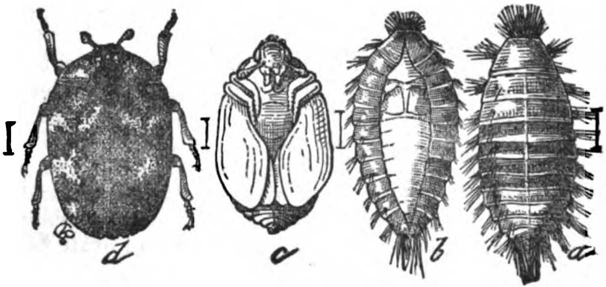


Fig. 1.

Perhaps a few additions to Mr. J. A. Lintner's very interesting article will not be out of place. In 1872 the late Mrs. W. P. L. Garrison came to visit the Museum, and told me about an insect destroying the carpets in Buffalo, N. Y., and named there "the Buffalo pest." I had not then heard anything about the insect, and Mrs. Garrison, after her departure, was kind enough to send me some living specimens from Buffalo. I bred them here in the Museum, and determined them as *Anthrenus scrophulariæ* L. The following years I had numerous inquiries from Cambridge and Boston in relation to this carpet pest, and I traced about three-fourths of all cases to a large carpet store in Washington St. in Boston, where the carpets were bought, and what ought not to have been done, they were directly laid in the rooms, without beating them before strongly and disinfecting them in some way.

Mr. Lintner was unable to find any record of its preying upon carpets or other woollens in the Old World. But there exists enough in the literature. Dr. H. Noerdlinger, in his well-known book, "Die kleinen Feinde der Landwirthschaft," etc., 1855, 8vo., p. 90, states as follows:—

"The common flower-beetle, *Anthrenus scrophulariæ*, is from April common on many flowers, especially on fruit trees and roses. It is common also in houses, etc., where it can become very obnoxious by the destruction of furs, clothes, animal collections, and even leather and dried plants. The obnoxious larva, which naturalists should take care to avoid, is common in closets and rooms in the attic, where it finds dead flies and from whence it likes to enter the other rooms."

I have taken Noerdlinger's book at random, but it would not be difficult to find such notices in similar books. To show that this pest is not a new one, I add two older authors taken at random.

F. W. Herbst, Coleoptera, vol. 7, 1797, p. 828, says:—"This beetle is everywhere very common in rooms, on buds, and especially common on tulips. It destroys, as well as its relatives, collections of insects and plants. The larva lives in he houses, like the *Dermestes*, and destroys all kinds of collections of natural objects, cloths, furs, leather and victuals." The variety of *A. scrophulariæ—sutura grisea*—is described from Europe by Illiger, 1798, p. 398. F. Wiegmann, Handbook der Zoologie, 1832, p. 308:—"The larva lives on animal matters, and is sometimes very injurious to hides."

I have ascertained this summer that the carpet bug eats of a piece of cloth consisting half of worsted, half of cotton, only the worsted threads, and left the cotton threads uninjured.

I may add some words concerning the list of the obnoxious insects introduced from

Europe into America. It is, as I believe, overlooked that about three-fourths of the insects enumerated are surely not originally European insects. They were introduced into Europe from the East by the advancement and progress of culture, and in the same way by the advancement of culture from Europe to America. The same is the case with the common weeds, and some years ago, by carefully comparing the list of European weeds in Prof. Ratzeburg's work with the lists of the described American plants, I found out that two-thirds of all European weeds are common in the United States, and perhaps a part of the last third, of which I was not able to make certain. I myself was at first much surprised to find in the middle of the prairie, near the railway to St. Paul, Minn., common European weeds. I should state that I share entirely in the wishes of the inhabitants of N. America to receive and enjoy progress and advancement of culture, without the accompanying drawbacks which nature seems to have so closely united with them.

After all, I should state that it is remarkable that such pests as the Colorado beetles emigrate very exceptionally from the west to the east; so the locust tree is even now entirely free from pests in Europe, though imported a century ago and very common everywhere. There are some American insects imported into Europe which have been overlooked. *Blatta Americana* is common in all sugar refineries to Archangel, and everywhere in large cities in store-houses. *Termes flavipes* is probably also imported from this continent. *Blatta orientalis* was imported from Asia to the west of Europe, and made from there a well ascertained migration to the east again and through Siberia. All insects finding it easier to live in the company of man, or by articles used and needed by man, will of course follow him as well as dogs and rats.

Mr. Lintner has not mentioned *Phylloxera*, which has in Europe done more injury and has caused more losses than almost all the other pests together.

NOTES ON THE HUMBLE BEES.

BY G. J. BOWLES, MONTREAL, P. Q.

(*Read before the Montreal Branch of the Ent. Soc. of Ontario.*)

Packard places the Hymenoptera at the head of the Class Insecta, on account of the completeness of their transformations and the perfection of their instincts. This is also the position assigned to this Order by Dana. Packard ranks the Bees (Apidæ) at the head of the Hymenoptera, thus placing them at the very summit of the insect creation. Cresson, however in his "Catalogue of the Described Species of N. A. Hymenoptera," has them a long way down the list, after the Ants, Wasps, etc. Who shall decide when such authorities disagree?

I wish to draw attention to the Humble Bees of this part of Canada, giving, as far as I can, the names of the species found here and some notes on their economy, the latter chiefly taken from Putnam's paper published in 1863.

The genus *Bombus*, says Swainson, appears to be a Northern and chiefly European and American genus; there are very few inter-tropical species, and very few Oriental. Some of the tropical species, however, are very large, much larger than those found in temperate climates. As regards North America, Cresson, in 1863, enumerated 46 species, of which the greater number are found in the northern part of the continent. I have carefully tabulated his list, and find that the arrangement of their habitats is as follows, beginning at the south: Mexico 6, Southern States 3, Middle 7, Western 5, Kansas and Utah 8, California 2, New England 8, Canada 7, Hudson Bay 5, Arctic 13, Sitka 3, Greenland 1, unknown 3, and one species from Antigua. The large number from Arctic America is surprising, and would lead one to think that the number given for the more southern parts is not correct. The Arctic species, however, are peculiar to that part of the continent, only three of them being found in Hudson Bay Territory, and only one of them coming as far south as Canada. Many of the other species are also local, but some are found over a wide area. Thus *virginicus* is found all over Canada and the United States, east of the Rocky Mountains, *vagans* from Canada to the west, *fervidus pennsylvanicus* and *separatus* the same, and *ternarius*, the only arctic species found in Canada (according to Cresson), seems to extend also over the North-Eastern, Middle and far Western States. Britain possess about 40 species.

The common name, Humble Bee, is said to be derived from Hummel or Hummer Bee, alluding to the noise made by the wings during flight. In Scotland the largest species found there is called the Bumbee.

In North America the Humble Bee is the nearest approach we have, as far as indigenous Bees are concerned, to the Hive Bee. The latter (*A. mellifica*), however, has become naturalized on this continent in the forests to a considerable degree beyond civilization, making its nests in hollow trees, or among the branches, sometimes under ledges or in clefts of the rocks. It is said not to have been found to the West of the Mississippi before 1797, but in fourteen years it had advanced 600 miles further in that direction. I have never heard of the Honey Bee becoming wild in Canada, but it probably would if neglected when swarming takes place.

To return, however, to the Humble Bees. They do not form communities so large as Honey Bees, seldom more than two or three hundred occupying one nest, in some species not more than fifty or sixty. The community is dissolved on the approach of winter; the males and workers die, and only females have the power of passing the winter in a torpid state, among moss, in rotten wood, or in some other situation where they may enjoy protection from frost and concealment from enemies—to perpetuate the race by founding new communities in the ensuing spring. Workers are chiefly produced in the earlier part of the season, males and perfect females in the latter part of it. The females are much less prolific than those of Honey Bees, and seemingly as a kind of provision for this deprivation, they, unlike the Honey Bees, live in the same community without seeking to destroy one another, provided they belong to the same colony or nest.

Their nests are placed in different situations, some species having different habits from others in this respect. Thus of the English species, *B. terrestris* makes its nest in holes in the ground, at the depth of a foot or more, floored with leaves and lined with wax, and often entered by a winding passage. Others, as *B. lapidarius*, make their waxen nests among stones; others, as *B. muscorum*, among moss, which they mix and join with wax. The nests are enlarged as the community increases. In the spring the female or queen bee, having awaked from her torpid state, roams about until she finds a suitable place for a nest. On deciding, she immediately collects a small amount of pollen mixed with honey, and in this deposits from seven to fourteen eggs, gradually adding to the pollen mass until the first brood is hatched.

As regards the Bees which I have examined, some were taken at Quebec by me some years ago, and one or two species here. I have to thank Mr. Caulfield for the principal part of the material.

There are certain differences between the sexes which render it easy to distinguish them. Not to enter too scientifically upon this part of the subject, I give the principal points of difference.

The females may be known by their large size, and the corbiculæ or baskets on the posterior tibiæ, formed by a fringe of long hairs on *each side*.

The workers generally resemble the females very closely, the only observable difference being in the size, and this varies greatly. They may be found of all sizes from the female downwards, so that it is impossible to tell the difference in some cases.

The male is smaller than the female and larger than the generality of the workers. It has one joint more in the antennæ and one section more in the abdomen than the female.

Cresson says a very conspicuous character to distinguish the sexes is this: In the male the inner tooth of the tarsal claws is almost as long as the outer, in the female the inner tooth is quite short compared with the outer. The posterior tibiæ are without baskets, but have a fringe of hairs on the outer side.

APATHUS, *Newn.*

The following remarks on this genus are from Mr. Cresson's "List of the North American species of *Bombus* and *Apathus*," Proc. Ent. Soc'y Phil., 1863:

This genus is parasitic on that of *Bombus*, and resembles it very much in general appearance. The characters with which to distinguish it from *Bombus* are as follows:—The posterior tibiæ are destitute of corbiculæ (or baskets) and are convex exteriorly; the basal joint of the posterior tarsi has no tooth at its base above. In the *female* the apex of the abdomen curves under, and the apical segment beneath has the lateral margins elevated. The mandibles have a single notch, while those of *Bombus* are distinctly toothed. This genus has no workers.

The males may be distinguished from those of *Bombus* by the posterior tibiæ being exteriorly convex and thickly coated with short hairs. The males of the latter genus have the exterior surface of the posterior tibiæ concave in the centre, with a few scattered hairs, and are fringed at the exterior margins.

The economy of our species is almost unknown.

LIST OF BEES OF THE GENERA BOMBUS AND APATHUS TAKEN IN THE PROVINCE OF QUEBEC.

BOMBUS, *Latreille.*

Virginicus, Oliv.—1 male, 4 females, 1 worker; Quebec, Montreal.
Separatus, Cresson.—1 male; Montreal.
Vagans, Smith.—2 females, 1 worker; Quebec, Montreal.
Perplexus, Cresson.—1 male; Montreal.
Fervidus, Fab.—1 male, 3 females, 2 workers; Quebec, Montreal.
Pensylvanicus, DeGeer.—1 female; Montreal, Quebec (Provancher).
Terricola, Kirby.—2 females; Quebec, Montreal.
Ternarius, Say.—1 male, 6 females, 2 workers; Montreal, Quebec.
Flavifrons, Cresson.—1 male, 3 workers; Montreal.
Sylvicola, Kirby.—8 workers; Montreal.

APATHUS, *Newm.*

Ashtoni, Cresson.—1 male, 2 females; Quebec, Montreal.
Elatus, Cresson.—3 females; Montreal.

INSECT DESTRUCTIVE TO PINE TREES.—NEPHOPTERYX ZIMMERMANI.

BY D. S. KELLICOTT, BUFFALO, N. Y.

This pine-boring Pyralid was described by Prof. A. R. Grote in a paper read at the Nashville Meeting, 1877, of the American Assoc. for the Adv. of Science, and published in *Canadian Entomologist*, vol. ix., 161. During the summer and autumn of 1878, and again this year, I have made some observations upon the occurrence, larval habits and parasitic enemies of this moth, and am able to state concerning them some additional facts of interest.

The moth, it appears, is pretty widely spread, and it seems rather odd that it should not have been discovered until 1877, having been overlooked by our excellent economic Entomologists. I have met with it in some one of its stages in the following localities: It occurs not uncommonly in both foreign and native pines in and about Buffalo; many of the trees of this species in the Niagara St. Parks have been bored by it. I found it quite abundant in small white pines of the forest at Chehtowaga, Erie Co., N. Y. At this place I found many plants had been dwarfed and ruined by their ravages. It also occurs, to what extent I am unable to say, at Hamburg and Clarence Center, in the same County. I recently visited a portion of this State, Oswego Co., formerly clad to some considerable extent with white pine, and there are yet standing some virgin forests of this splendid tree. In divers places in that county I found our borer; it is so abundant in one locality, at least, that it proves a grave enemy to the young pines of second growth where the primitive trees have been removed by the lumberman. There is near Hastings Center an "old slash" in which at least one-half of the many such small pines have been injured; indeed, in one neglected corner, among scores, scarcely one tree had escaped. In this instance, also, many pines were stunted, while some thus weakened had been broken off by the wind. In other localities where the pine is indigenous I have been unable to find it, or else it was only occasional; for example, at Portage, where young pines are plentiful, and although the trunks bore masses of pitch closely like those from the wounds by *Zimmermani*, yet a diligent search discovered but one pupa skin, and of the identity of it I am not quite certain, as it was badly broken in removing from the pitch.

April 12th last, at Hastings, I took many larvæ of various sizes from .25 to .7 of an inch in length when crawling, so there is no longer a doubt as to the winter stage. None of these taken were "livid or blackish green," but dull white; nor do the hairs arise from a "series of black dots," but from light brown ones. I take it to be a case where a naked hybernating larva is lighter than during the warm summer. Otherwise the caterpillars were as described by Mr. Grote.

In a clump of pines whose trunks were from 6 in. to 1 ft. in diameter many of the larger ones had been "boxed," i. e., inclined incisions had been cut by the axe through the sap-wood in order to catch the pitch exuding from the wound. Around the borders of these "boxes" the galleries with both pupa skins and living larvæ were plentiful. It appears that the larva cannot penetrate the outer bark of other than quite tender trees; nor could I find evidence of their attacking the branches of larger trees, although I had opportunity to examine such that had been felled during the winter just past. Since this larva so readily take advantage of a wound, may it not stand related as a *messmate* to other borers? At both Chehtowaga and Hastings I found on trunks in the same neighborhood masses of exuding pitch in which were larvæ of an orange colour, attaining a length of .45 of an inch, remaining through the winter, and going into pupa towards spring, as I found them in both conditions April 12th and early in May. These larvæ are those of one of the *pine weevils*. It appears to me that *Zimmermani* may and does take advantage of these wounds by the weevil, as it does of those made by the axe.

I have found the moth's galleries in both trunk and branch, both above and below the whorls (usually below), sometimes completely girdling the stem, thus killing the portion above; in one instance I found a gallery passing from one whorl to the one above.

Now, when the moth borer and the weevil work together and pretty much in the same way, *i. e.*, by cutting the inner bark and the cambium layer, thus scoring and girdling the stem, to which culprit belongs the greatest amount of credit for mischief? Both are guilty of enough to justify everlasting execration.

It remains to add a word about its insect enemies. The hymenopterous parasite which Mr. Grote found to fill certain of the chrysalids, I have found in every location where the moth is at all abundant; there is another which I have found quite as abundant. Early in April I obtained from the galleries of last year a number of brown cocoons, about .4 of an inch long, nearly cylindrical, ends rounded, texture thin papery, pupa visible through the cocoon. The skin and head of the victim was found at one end of this cocoon, showing that the caterpillar was the host.

In a few days there appeared from each cocoon a lively fly. Expanse of male, .6 in.; of female, .7 in. Colour above black, legs yellow, underside of abdomen white with a row of black dashes on side, front of male white, of female black. A white line on shoulder of each extends on to the costa. Ovipositor as long as the abdomen.

I shall presently refer the species for identification.

NOTES ON THE LARVA OF THE MAY BEETLE—LACHNOSTERNA FUSCA.

BY L. O. HOWARD, WASHINGTON.

The following note may prove of interest as showing the numbers in which the larvæ of *Lachnosterna fusca* may exist in a lawn without perceptible damage to the grass resulting.

On the 17th of September, while walking through the Capitol grounds a few hours after a heavy shower of rain, I observed these larvæ in great numbers upon the stone pavement north and east of the Capitol building. I counted up to three hundred, and then came to a spot where they were so thick that I had to give it up. I certainly saw *thousands*, nearly all of which were dead, either from heat or from having been trodden upon. Upon interviewing the Superintendent of the ground, I learned that at this season of the year the grubs always make their appearance in like numbers after a hard rain. This gentleman informed me, and his statement was corroborated by several others, that frequently the sweepers of a morning in going over the walks would collect at the bottom of the hill as many as a *bushel* of the grubs. The pavement is edged on both sides by a two-inch curb, and the larvæ falling over this are unable to return; only those grubs inhabiting the earth near the curb would reach the walk, and the great numbers killed in this way after every shower afford an index to the immense number which the entire lawn must contain. Yet, in spite of this most serious drawback, as one would naturally call it, the grass over the entire plot is so fresh and green as to call for universal admiration.

The movements of the larvæ upon the smooth pavement were very interesting. The characteristic bend of the body unfits them for walking on smooth surfaces, and every live individual that I observed was upon its back, moving forward quite rapidly by the alternate expansion and contraction of the segments. This mode of locomotion seemed strange at first, but upon reflecting that the probable natural position of the larva in the earth is upon its back with its legs grasping the grass roots, it seemed not so unnatural after all. The strong transverse corrugations and rows of bristles upon the dorsum, taken in connection with the extremely business-like and natural air with which the larvæ took this position and the rapid progress which they made while in it, would seem to indicate that the back is used for locomotion with these insects more than has perhaps been suspected.

OTTAWA FIELD-NATURALISTS' CLUB.

We are glad to learn that the Naturalists resident in Ottawa have organized under the above heading, with the avowed object of paying special attention to the Natural History of the Ottawa District. The Club is under the patronage of His Excellency the Governor-General, and has an efficient staff of officers; among whom we observe the names of two of our esteemed contributors, J. Fletcher and W. H. Harrington, both enthusiastic Entomologists, and we are pleased to see Entomology so well represented in this connection. It is intended to have occasional excursions during the summer, and evening meetings during the winter for the pursuit and discussion of Natural History subjects. Already the Club has had one very successful excursion, the party numbering in all, ladies and gentlemen, about forty. We should like to see such clubs organized in every city in our Dominion. There is a growing fondness for this interesting study, especially among our young people, and a little stimulus of this sort would materially aid in developing it.

OBITUARY NOTICES.

W. V. ANDREWS.

It becomes our painful duty to announce the death of one of our correspondents, Mr. W. V. Andrews, of Brooklyn, N. Y., who died on the 20th of October, 1878, after a brief illness, resulting from a sudden attack of paralysis.

William Valentine Andrews, was born on the 11th of February, 1811, in Pilton, Somerset, England. At an early age he entered the British service, and served as a private in the Coldstream Guards, rising eventually to the rank of Captain. Subsequently he resigned his commission and removed to Canada, where he resided for several years in London, Ont., engaged in the book and periodical business. From thence he removed to the United States and settled in Brooklyn, where he spent the last few years of his life in the same branch of business, devoting his leisure time chiefly to the study of Entomology, in which he made rapid progress. He had a well arranged collection of Coleoptera and Lepidoptera, and a small but well selected library of Entomological works. His remains were interred at Rosedale Cemetery, New Jersey.

Since his decease his collections and library have been purchased by Mr. John Akhurst, of Brooklyn, N. Y.

FREDERICK SMITH.

Another veteran in the Entomological ranks has passed to his rest. Frederick Smith, the renowned English Hymenopterist, is no more; he died on the 16th of February, in the 74th year of his age, from exhaustion consequent on a painful and dangerous surgical operation. He was born in London, England, in 1805, and in early life was apprenticed to Mr. W. B. Cooke, an eminent landscape engraver, where he acquired a very thorough knowledge of the engraver's art, which was of great use to him in after life. While still a young man he became an ardent collector of bees and ants, and also devoted some attention to the collecting of Coleoptera; but it was not until 1837 that the first paper from his pen was published, giving an account of the natural history of one of the Gall Flies. From 1842 to the time of his death his publications were very numerous and of great value. A most industrious man, a painstaking and methodical student, and an accurate observer, he has done very much to advance our knowledge of the Order in which he especially laboured. By his death Entomology loses a sincere and talented advocate and an earnest votary, and Entomologists will greatly miss a friend who was ever ready to impart his knowledge to others.

UNITED STATES ENTOMOLOGICAL COMMISSION.

The Entomologists composing this commission have during 1879 devoted their attention mainly to an investigation in reference to the Hessian Fly, an insect which has entailed untold losses on the agricultural community both in this country and the United States. Early in the year the following circular was issued and widely distributed among Entomologists and farmers. A large amount of information has in this manner been gathered and we look forward with much interest to the appearance of the report on this important subject.

DEPARTMENT OF THE INTERIOR—OFFICE OF THE U. S. ENTOMOLOGICAL COMMISSION.

Providence, R. I., June, 1879.

DEAR SIR,—The Commission desires your co-operation in obtaining facts concerning the habits of the Hessian Fly, with statistics of losses occasioned in your town or county by its attacks; and accounts of the remedies best calculated to prevent its increase, and to destroy it. In brief the habits of the Hessian Fly are as follows: In May and June two or three small reddish-white maggots may be found embedded in the crown of the roots of the wheat, at or near the surface of the soil, causing the stalks and leaves to wither and die; the maggots harden, turn brown, then resembling a flax-seed, and change into little *black* midges with *smoky* wings, half the size of a mosquito, which appear in spring and autumn, and lay from twenty to thirty eggs in a crease in the leaf of the young plant. Specimens of the fly may be obtained by sweeping the wheat when three or four inches high, with a gauze net. Please send me specimens of the fly, eggs, maggot and "flax-seed," in vials of alcohol, which notes as to the date when found, and full information as to the insect enemies and parasites.

The *Wheat Midge* is apt to be confounded with the Hessian Fly. It is a small, mosquito-like fly, *orange yellow*, with clear wings, which hovers over fields of young wheat in June. It attacks the heads of the wheat, laying its eggs when the wheat is in blossom. On hatching, the maggots crowd around the young kernels of wheat, causing them to become shrivelled. The maggots in July and August descend into the ground, spinning a round cocoon smaller than a mustard seed, remaining an inch below the surface till the following June.

Information regarding the following topics is respectfully solicited ; to be forwarded at the close of the season :

1. When, where, and how are the eggs deposited?
2. When does the maggot appear?
3. When is the "flax-seed" state of the Hessian Fly, or the seed-like cocoons of the Wheat Midge assumed?
4. At what date do the Midges appear in spring and autumn?
5. Look for minute parasites in the eggs and maggots. They may be bred by placing the eggs and maggots with the wheat in bottles covered with gauze, and the parasitic flies preserved in vials of alcohol,
6. Give statistics as to abundance and losses in your town.
7. State the best preventive remedies, as deep ploughing or burning in the fall, or the rotation of crops.

Specimens of wheat affected by these insects, and of the eggs, maggots and flies, together with their parasites, in alcohol, are requested. When mailed, the alcohol can be poured out, and cotton soaked in alcohol will keep the specimens wet until received. Packed in a tin box they can be sent through the mail. Address as below.

Respectfully yours,
A. S. Packard, Jr., Providence, R.I.

CANADIAN CUT-WORMS.

By G. J. Bowles, Montreal.

The term "Cut-worm" is popularly applied to certain caterpillars or larvæ which have the habit of cutting the stems of young plants, either just above or just below the surface of the ground. The name is also often given to the larva of the May-beetle, (the "white grub,") and to wire-worms, &c.; but it is especially appropriate to the caterpillars of some of the night moths belonging to the genera *Agrotis*, *Hadena*, *Mamestra*, &c., which are noted for the destructive habit above referred to.

In Europe there are many species of these insects, which at times prove very injurious to vegetation. Some despoil the fields of wheat and other grains, others attack the vineyards, others again devastate the meadows, while others do great damage to root crops and garden vegetables. These belong principally to the genus *Agrotis*, and in the same genus are placed several of the American moths which produce our cut-worms.

The natural history of these worms is thus given by Mr. Riley, in his first Report, (Missouri) :

"The parent moth attaches her eggs to some substance near the ground, or deposits them on plants, mostly during the latter part of summer, though occasionally in the spring of the year. Those which are deposited during late summer, hatch early in the fall, and the young worms, crawling into the ground, feed upon the tender roots and shoots of herbaceous plants. At this time of the year, the worms being small and their food plentiful, the damage they do is seldom noticed. On the approach of winter they are usually about two-thirds grown, when they descend deeper into the ground, and, curling themselves up, remain torpid until the following spring. When spring returns, they are quite ravenous, and their cutting propensities having fully developed, they ascend to the surface and attack the first green succulent vegetation that comes in their way. When full grown they descend deeper into the earth, and form for themselves oval chambers, in which they change to chrysalids. In this state they remain from two to four weeks, and finally come forth during June, July and August as moths, the chrysalis skin, being in most cases so thin, that it is impossible to preserve it. These moths in time lay eggs, and their progeny goes through the same cycle of changes."

The worms vary in size and markings, but they are all smooth, naked, and greasy looking, and are of some shade of green, grey, brown or black, with a polished, scaly head, and a shield of the same colour on the top of the first and last segments; while most of them have several minute shiny spots on the other segments, each spot giving rise to a minute stiff hair. They also have the habit of curling up when disturbed.

The moths are of sombre colours, and fly generally at night, often entering lighted rooms, even in large cities. The upper wings always have two more or less distinctly marked spots, one round, the other kidney-shaped, and the lower wings are generally grey or white, without spots.

The history of American Cut-worms has engaged the attention of some of our best entomologists:—Fitch, Harris and Riley, amongst others, have studied them closely; the last mentioned, however, being the only one who has fully surmounted the natural difficulties in the way of rearing the larvæ, caused by their restless and peculiar habits. In the Report already quoted, Mr. Riley has given the life history of ten species, all of which are found in Canada, and as a knowledge of the habits of our species is of considerable importance to our people, I shall briefly notice in detail those which are most numerous and destructive.

As to the injuries caused by these caterpillars, they are so well known that it is hardly necessary to recapitulate them. It is chiefly during May and June that they are found to be most destructive, at the time when the young corn and other plants are a few inches high, and the stems of cabbages and other garden vegetables are young and succulent. Even the flower garden suffers from their attacks, and our balsams, pinks and other flowers, are ruthlessly destroyed by them. And (what is of more interest to our fruit-growers) some species (which are also found in Canada) have the habit in early spring, of ascending fruit trees and destroying the young buds, both of the leaves and blossoms, thus disappointing the hopes of the fruit-grower, and sometimes killing the trees.

AGROTIS DEVASTATOR.—*Brace.*

The Devastating Dart Moth—Larva—The Glassy Cut-worm.—Riley.

This is one of the most common of our Cut-worm moths, and is distributed over a wide area, being not only found in Canada, but also all over the Northern and Western United States.

The eggs are doubtless laid in the autumn, as when the worms are found in May, they are nearly full grown. Mr. Riley calls it the "Glassy Cut-worm," from its translucent glassy green body, in contrast with a very distinct hard polished dark brown shield on the first segment, and a bright venetian-red head. There are several small spots on each segment of the body, and it is very sparsely studded with hairs. This Caterpillar, figure 2, after Riley, is the "Cabbage Cut-worm" of Harris, and often does great injury in gardens. Their depredations are carried on for four or five weeks in May and June, and they appear as moths from the latter part of June until September. The larva feeds on wild plants as well as cultivated, for Mr. Riley found the specimen from which he reared the moth, "under a wild endive plant, on the leaves of which it had evidently been feeding."

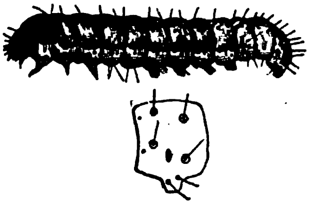


Fig. 2.

The moth is about 1¾ inches across the wings; the fore wings are dark ashen grey, with a satiny lustre, and are crossed by four narrow wavy whitish bands, edged on each side with black, there is a transverse row of white dots, followed by a row of black, arrow-headed spots between third and fourth bands, and three white dots on the outer edge near the tip; the ordinary spots are edged with black and white, and there is a third spot of oval shape and blackish colour, near the middle of the wing and touching the second band. The hind wings are light brownish grey, with a blackish border. (*Harris*) As is usual with moths of this genus, there is considerable variation in the intensity of these markings.

AGROTIS TESSELATA.—*Harris.*

The Checkered Rustic Moth—Larva—The Striped Cut-worm.—Fitch.

Common in Canada and the Northern States. This moth is evidently the same as that so fully described by Dr. Fitch in his Ninth Report (New York), as *Agrotis nigricans* Linn. variety *maizi*. The worm is notorious for its depredations in cornfields, as the name —*maizi*—given to it by Dr. Fitch, indicates. It cuts off the plant about half an inch or an inch *above* the surface of the ground, and thus many of the plants, though severed, may survive the injury, and send up new leaves from the stump.

The striped Cut-worm, as Fitch calls it, is from an inch to an inch and a half in length. Its ground colour is dirty white or ash grey, sometimes tinged with yellowish, the shield on top of first segment is shining black, with three whitish longitudinal stripes, a whitish line along middle of back, between two black ones, and on each side of the body three dark and two pale stripes, sometimes another whitish stripe below the lowest dark one, and all the under part of the body pale white. Head black with a white stripe along the middle. (*Fitch*).

These worms attack the corn during the month of June, and after changing to chrysalids in the ground, come forth in the moth state from the middle of July to the end of August.

The moth is about 1¼ inch. in expanse, and is dark ash coloured, with but faint traces of the ordinary bands. It may be easily identified by the two ordinary spots on the fore wings being large and pale, and separated by a square black spot. There is also a triangular black spot in advance of the smaller pale spot, and a small black spot near the base of the wing. The hind wings are brownish grey, with a blackish border. It is a variable insect.

HADENA ARCTICA.—*Boisduval.*

Hadena amica.—Harris. *Hadena amputatrix.*—Fitch.

Larva—The Yellow-headed Cut-worm.—Fitch.

Very common in Canada, East and West, also over the northern United States. It is a larger moth than those previously described, and has greater pretentions to beauty.

This is another of the Corn Cut-worm moths. Dr. Fitch has named the caterpillar the Yellow-headed Cut-worm, and describes it and its habits at great length in his Ninth Report. The worm is of a smoky or livid brown colour, with a yellow or chestnut coloured head, and a horny shield of the same colour on the first and last segments of the body. It grows to a larger size than other Cut-worms, and is peculiarly destructive because it severs the plant about an inch *below* the surface of the ground, thus destroying it irremediably. They also attack the corn till a later period than the preceding species.

According to Harris, this worm has also the habit of climbing bushes and young trees, to devour the buds, thus combining the habits of the ordinary Cut-worms with those of the climbing species described by Mr. Riley.

The moth appears during July and August, and is a large one, measuring nearly two inches across the expanded wings. The fore-wings are of a deep spanish brown, variegated with grey. The small ordinary spot has a grey border. The kidney spot is large, grey, and very conspicuous. There is a broad wavy pearl-grey or blue-grey band across the hinder part of the fore wings, and also a narrow wavy band between the oval spot and the shoulder. The hind wings are ash-coloured, with brownish margins, and have a pale border, and a central blackish spot underneath. The body is brown and rust-red *Harris*). The moth flies at night and often enters lighted rooms in the evening.

AGROTIS TELIFERA.—*Harris.*

The Lance Rustic—Larva—The Greasy Cut-worm.—Riley.

Very common in Canada, from June until October; and also at least as far west as Missouri.

The greasy cut-worm, when full-grown is about one inch and a half in length, and generally of a dull leaden brown, sometimes inclining to black. It has a faint dirty yellowish line along the back, a more distinct one on each side, and below each of these, two other indistinct pale lines. It has also eight or nine black shiny spots on each segment; the head is light brown with a dark spot on each side, and dark brown above, and the shield on neck is dark brown, except a stripe above on each side. The sides and posterior portions of the body are studded with short white bristles.

This worm is one of the most injurious of its kind, possessing the *cutting* propensity in a very marked degree. In the Western States it is extremely destructive to corn, tomatoes, tobacco, and many other cultivated plants, cutting them off about an inch above the ground, and attacking plants of quite a large growth. It seems to act almost from mere wantonness, one worm often ruining several plants in a single night, by severing them one after the other. It is a very general feeder, and will thrive on apple or grape leaves, when it can get nothing else.

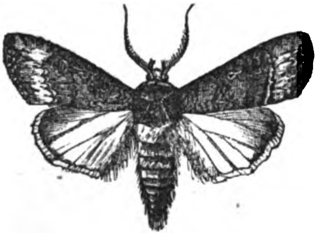


Fig. 3.

The moth, figure 3, (after Riley) first described by Harris, is rather a large insect, being about one and a half inches in expanse. It closely resembles the *Agrotis suffusa* of Europe, so much so that Mr. Norman in his list of Canadian Noctuidæ (Can. Ent. 1875) calls it by the latter name. (Mr Grote, in his Check List, places both these names as synonyms, and calls the moth *Agrotis ypsilon*, Rott.) The following is the description by Harris:—The fore wings are light brown, shaded with dark brown along the outer thick edge; and in the middle also in the female; these wings are divided into three nearly equal parts by two transverse bands, each composed of two wavy dark brown lines; in the middle space are situated the two ordinary spots, together with a third oval spot, which touches the anterior band; these spots are encircled with dark brown, and the kidney spot bears a dark-brown lance-shaped mark on its hinder part; (whence the name of the moth), the hindmost third of the wing is crossed by a broad pale brown band, and is ornamented by a narrow wavy or festooned line, and several small blackish spots near the margin. The hind wings are pearly white, and semi-transparent, shaded behind and veined with dusky brown.

Mr. Riley states that he found the worms two thirds grown on the 22nd of May, and that it becomes a chrysalis at the end of that month, though the moth does not make its appearancce (in Missouri) until July. Mr. Norman's note on the species is: "Swarming at sugar, flowers and light, from 2nd June until October." I myself took a fine fresh specimen this year at Montreal, on the 1st October, at sugar. These facts seem to indilate that there are two broods of the insect each year, if not more.

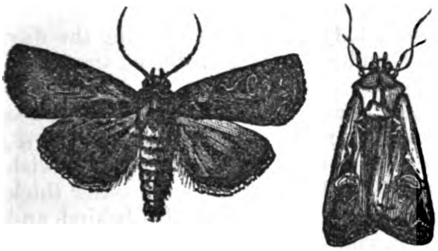
AGROTIS SUBGOTHICA.—*Haworth.*

The Gothic Dart Moth—Larva—The Western Striped Cut-worm.—Riley.

Common in Canada, and the Northern and Western States. It was first described in the year 1810 by Mr. Haworth, and is supposed to be an English insect; but as it is quite rare in England, and very common in America, Dr. Fitch and Mr. Riley are of the opinion that it is an American Insect, the eggs or larvæ of which have been accidentally carried to England.

The caterpillar of this moth much resembles that of *Agrotis tesselata*, described on a previous page. The ground colour is a dirty white or ash-grey, and it has three broad dark lines and two light narrow ones on the sides, and a light line edged on each side by a dark one along the centre of the back. The head is black. Mr. Riley, (who describes the worms as above), found them in an orchard and gives them the name of the "Western Striped Cut-worm."

Their habits are not yet clearly made out but they are probably similar to those of the next mentioned species, which Mr. Riley considers distinct, but Mr. Grote looks upon as identical.



a. Fig. 4. *b.*

The markings of the moth are very conspicuous and somewhat resemble those of *Agrotis tesselata.* In figure 4 *a* represents the moth with the wings expanded, *b* with the wings closed. The fore-wings are greyish brown along the front edge, the two spots are of the same colour, and the black intermediate spot, which is square in *tessalata*, is rhomboidal in this species, and joined to the triangular spot on the inner side. There is also a large black spot below the kidney-shaped one, and a long blackish dash, extending from the base of the wing, about half-way down the wing near the inner edge, divided into three spots by two narrow diagonal brown lines. Between this dash and the series of spots near the outer edge of the wing is a light brown stripe, narrowest at the base. The insect expands about an inch and a half, and appears during August and September.

AGROTIS JACULIFERA.—*Guenee.*

The Dart-bearing Rustic Moth—Larva—The Dingy Cut-worm—Riley.

Mr. Riley has reared this insect from a cut-worm, which differs from that of the preceding species, *(subgothica)* only in the following particulars: It is never so large, it is generally darker and of a more dingy colour, the longitudinal lines are less distinct, and the back is of a more decided pale buff. The worms were found in the garden, and the species had proved quite destructive in the vicinity.

The moth, like its very near relation, is common in Canada and appears in August and September. The wings are marked in almost exactly the same way as *subgothica*, but are much brighter in colour, although the larva is so much more dingy in appearance than that of the former species. The lighter parts of the fore wings are almost silvery, instead of brown, and the darker parts of a more decided black. The inner edge of the wing is also much lighter. Mr. Riley also states that the chrysalis differs from most of the others in being of a very light honey yellow, shaded with brown. The moth is taken in July, August, and September.

AGROTIS INERMIS.—*Harris.*

The Unarmed Rustic Moth—Larva—The Variegated Cut-worm.—Riley.

Common over Canada, the Northern and Western States. This moth is one of the largest of its genus, and so closely resembles the *Agrotis saucia* of Europe, that many entomologists consider them identical.

We are indebted to Mr. Riley for a lengthened history of the insect, comprising many interesting details. The caterpillar, (which he calls the "Variegated Cut-worm") is, when full grown, nearly two inches in length. It is mottled with dull flesh colour, brown and black, and has elongated velvety black marks on each side of the body. The head is light grey and mottled. The worm is a very general feeder, thriving on cabbage and grape-vine leaves, and even on the wild mulberry; while some which had hatched in a drawer, were found in a half grown state, having fed entirely on some apples which happened to be in it at the time. The eggs of the insect have been found early in Spring on cherry and apple twigs, and also on the leaves of the white mulberry, near St. Louis, Missouri. This fact leads Mr. Riley to think that, in the Western States, the moth is double brooded, as these eggs must have been laid by a female, which had passed the winter either in the chrysalis or moth state, and the transformations of the insect are completed by the spring brood in about thirty-five days. In Missouri the moths appear during the latter part of June, which would allow ample time for a second brood before winter. In Ontario, Mr. Norman records the capture of the moth on the 14th August.

The worms have the climbing faculty to some extent, lying concealed during the day under the surface of the ground, and ascending vines and other plants during the night for the purpose of feeding.

The moth expands about 1¾ inches, and is marked as follows: The fore wings are light brown, shaded in the middle and towards the hinder margin with dusky brown; they are crossed by four more or less distinct, wavy bands, each formed of two blackish lines; the kidney-spot is dusky; and there are several blackish spots on the outer thick edge of the wing. The hind wings are pearly white in the middle, shaded behind and veined with dusky brown. The thorax is reddish brown, with the collar and shoulder-covers doubly edged with black. The abdomen is grey (*Harris*). It is a very variable species, as regards the depth of colour.

AGROTIS MESSORIA.—*Harris.* THE REAPING RUSTIC MOTH.

Agrotis Cochranii (?) Riley—*Larva.*—*The Dark-sided Cut-worm.*—Riley.

This moth is described by Harris as the American representative of the Corn Rustic (*Agrotis segetum*) of Europe. It is in the list of the Entomological Society of Ontario, but I cannot say whether it is abundant in Canada or not. It is found in the Province of Quebec, but is not common.

Mr. Riley has described a moth under the name of *Agrotis Cochranii*, which Mr. Grote considers to be the same as *messoria*. In case they should prove to be identical, I give some extracts from Mr. Riley's very valuable article on *Cochranii*, on account of the peculiar habits of the larvæ, a knowledge of which is important to our fruit-growers.

The Caterpillar is one of the "climbers," and does great injury to the orchards in Michigan, and States further west, being most injurious in those growing upon light, sandy soils. The general colour of the worm is dingy ash-grey, but it is characterized more especially by the sides being darker than the rest of the body. When young, it is much darker, and the white, which is below the lateral band, is then cream-coloured and very distinct. It grows to a little more than an inch in length. (*Riley.*)

The following graphic account of the depredations of this caterpillar is from the pen of Mr. Cochran, of Calumet, Illinois; and is commended to the notice of the fruit growers of Ontario.

"In the beginning of the evening its activity is wonderful; moving along from limb to limb swiftly, and selecting at first only the blossom buds, to one of which having fastened, it does not let go its hold until the entire head is eaten out, and from this point, so thorough is its work, no latent or adventitious bud will ever again push. From a six-year old fruit tree, I have, on a single night, taken seventy-five of these worms, and on the ensuing evening, found them well nigh as plenty on the same tree. When all the blossom buds of a tree are taken, it attacks with equal avidity the leaf buds. It is no unusual thing to find small trees with every bud that had pushed, from first intentions utterly destroyed, and frequently young orchards the first season planted, on sandy grounds, lose from 50 to 75 per cent. of their trees; sometimes those remaining will be so badly injured as to linger along a few years, fruiting prematurely each season, and then die, utterly drained of their vital principle by this dreadful enemy. * * * It is far more destructive to fruit trees than any other insect, infinitely more so than the canker-worm, but unlike the other depredators of our orchard trees, it is easily kept in check, and at small expense permanently eradicated."

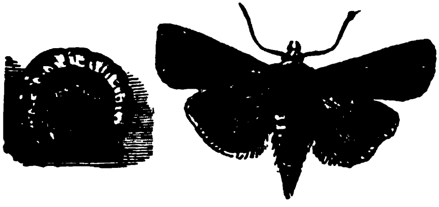


Fig. 5.

Figure 5 (after Riley), represents both the larva and perfect state of this insect. The moths appear during July and August, and expand about an inch and a half.

Mr. Harris describes *messoria* as follows:—"The fore wings are reddish gray, crossed by five wavy blackish bands, the first two of which, and generally the fourth also, are double; the two ordinary spots, and a third oval spot near the middle of the wing, are bordered with black. The hind wings are whitish, becoming dusky brown behind, and have a small central crescent and the veins dusky. The head and thorax are chinchilla-grey; the collar is edged with black; and the abodomen is light brownish-gray."

AGROTIS SCANDENS.—*Riley.*

The Climbing Rustic Moth—Larva—The Climbing Cut-worm.—Riley.

This moth, described by Mr. Riley in his First Report, is also on the list of the Entomological Society of Ontario. It is very common in the Western States, and the larva is very injurious to apple and other fruit trees, devouring the blossom and leaf buds in early spring, in the same manner as the species last described.

Even though it may not be common in Ontario, a knowledge of its habits is necessary, as our fruit-growers are often not aware of the reason why so many of their trees dwindle away and at last perish; and in many cases the loss may be caused by the attacks of this cut-worm, or others of similar habits.

The full-grown worm is nearly an inch and a half in length, and of a very light yellowish grey colour, variegated with dirty bluish green spots, and when filled with food it has a much greener appearance than at other times. In depth of shading, however, it is variable; and the young worm is of a more uniform dirty whitish yellow, with the lines along the body less distinct, but the shining spots more so than in the full-grown ones. There is a well-defined line along the back, and two lines along each side, less distinctly marked. The head and shield in first segment are tawny; the latter has a small black spot on each side, and the head has two in front and two eye spots on each side. (*Riley*).

The following is an account of its habits:—They hide under the surface of the ground during the day, but soon after dark begin ascending the trees to feed, remaining there the greater part of the night. When filled with food, they seem to suspend themselves to the limb by a thread, and drop to the ground. They seem to commence with the terminal buds, and when these are all gone, betake themselves to the side buds, thoroughly destroying all that they attack, so that the tree, if a small one, is often fatally injured. Apple, pear, peach and cherry trees are subject to their attacks and they are also very partial to grape vines. Like the preceding species, they are most abundant in orchards growing on light soils, and less frequent as the soil is more clayey; the light soil affording them easier access for purposes of concealment during the daytime.

The worms appear early in spring, and descend into the earth to become chrysalids about the end of May, coming forth as moths during June and July.

The perfect insect is about an inch and a half in alar expanse, the fore wings are a light pearly bluish grey, deepening towards the hind margin, and the hind wings are pearly white. The usual markings are generally indistinct, with the exception of the kidney spot and sub-terminal line. A black stain at the lower part of this spot forms a most disdinctive character, but the peculiar colour of the moth easily separates it from other species of its genus. At the same time it is, like nearly all the Agrotidæ, somewhat variable in colour.

AGROTIS CLANDESTINA.—*Harris.*

The Clandestine Owlet Moth—Larva—The W *Marked Cut-worm.*—Riley.

Very common in Canada, the Northern and Western United States.

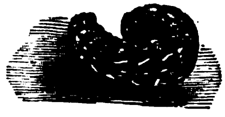


Fig. 6.

The larva of this moth fig. 6 (after Riley) is one of the climbers, but does not possess the habit to a marked degree. Though it has been caught eating apple buds, it seems to prefer low bushels, such as currants, &c., and its more congenial food is garden vegetables. The bill of indictments against this worm is a heavy one, as it has been found to attack wheat, young corn, buckwheat, young pumpkins, beans, cabbages, and many other garden plants. In feeding, it frequently drags its food under stones or into the ground, so that it may devour it at leisure.

The general colour of the worm is ash grey, inclining on the back and upper sides to dirty yellow, and it is finely speckled over with black and brown spots. Along the back is a fine light line, a light sulphur yellow line on each side, with a band of dirty brownish yellow beneath. The distinguishing feature is a row of black velvety marks along each side of the back, on all but the thoracic segments, and bearing a general resemblance, looking from tail to head, to the letter W, whence Mr. Riley has given it its name. Head black, with a white line in front like an inverted Y, and white at sides. It is about 1¼ inches in length. (*Riley.*)

The moth appears at the end of June. It is dark ash grey, with the usual wavy bands faintly traced. The two ordinary spots are small, narrow, and generally connected by a fine black line. The hind wings are dirty brownish white, somewhat darker behind. It expands about an inch and three-quarters. The wings, when closed, overlap on their inner edges, and cover the top of the back so flatly and closely that the insects can get into very narrow crevices. During the day they hide under the bark of trees in the chinks of fences, or the clapboarding of buildings. This peculiarity led Harris to give the moth its specific name of *clandestina.*

HADENA SUBJUNCTA.—*Grote and Robinson.*

The Subjoined Hadena—Larva—The Speckled Cut-worm.—Riley.

This moth, placed by Mr. Riley among the Cut-worm moths of Missouri, is also found in Canada. The caterpillar, when full grown, is about an inch and a half long, grey, with a tinge of rust colour on the middle of each segment, and is minutely speckled as with pepper and salt. It has an interrupted white line on the back with a similar one on each side and two spots on the back on the fore part of each segment. The head is light shiny brown. It feeds voraciously on cabbage leaves during the night, lying concealed and motionless in daytime.

The moths appear early in August, and are very distinct in appearance from those already described. They are of a dull flesh-coloured shade, marked with greyish brown and black. The ordinary spots are large, with a distinctly marked ring around them; and the abdomen is crested at the base. A full description of the insect is given by Mr. Riley, in his first Report, page 85, which is copied from that of Messrs. Grote and Robinson. It is not very common in Canada.

CELÆNA RENIGERA.—*Stephens.* C. HERBIMACULA.—*Guenee.*

The Figure 8 *Minor—Larva—The Small White Bristly Cut-worm.*—Riley.

The moth bearing this name is a pretty little insect, the fore wings being brown, variegated with lilac-grey, and mossy-green, and having a deep brown spot about the middle, and a silvery line, somewhat resembling the figure 8, around the kidney spot. It is much smaller than those previously mentioned, and has the wings broader and rounder in proportion.

The full-grown larva is a dirty-white cut-worm, about three-fourths of an inch long, covered with stiff yellow bristles, and is often found in flower gardens, where it is supposed to feed on the roots of flowers. During August it becomes a chrysalis in the ground, from which it issues as a moth in September, according to Mr, Riley, but Mr. Norman (Canadian Eutomologist, 1875) records it as very common at St. Catherines, Ontario, from 23rd June until October, and thinks there are two if not more broods of the insect each year.

OTHER CUT-WORMS.

In the preceding pages we have noticed twelve species of these caterpillars, the histories of which have been studied out. The reader will acknowledge that practical Entomology is deeply indebted to Mr. Riley, when it is stated that ten of these histories are the result of his researches. No doubt there are others which are injurious, but their economy is yet unknown. Among these is one which Mr. Riley calls the "wheat cutworm," the moth of which he has not, as yet, succeeded in rearing. He gives an account of it in his first report, and it may, perhaps, be found in Canada.

REMEDIES AGAINST CUT-WORMS.

NATURAL.—The means which nature has provided to check the increase of these worms, are, as in other cases, the attacks of predatory insects. Some of our well-known friends, belonging to the beetle, bug and ichneumon tribes, prey upon them and do good service. One of the most efficient is the larva of the fiery ground beetle (*Calosoma calidum*, Fabr.), which has been styled the "cut-worm lion," on account of the energy and activity it displays in hunting them. The larva is a flattened, black worm-like creature, with six legs on the fore part of the body, and a pair of sharp hook-like jaws projecting from the head, giving it quite a formidable appearance. It seeks the cut-worms even under the soil, and when it discovers one, fixes its jaws in the worm's throat with the grip and pertinacity of a bull dog, never letting go its hold until the larva succumbs and dies. It then feeds upon the contents of the body, and after a rest, goes in pursuit of a fresh victim.

Another beetle which preys upon them is the murky ground bettle (*Harpalus caliginosus*, Say.), and several others of the Carabidae are known to have similar habits.

Among the bugs, the spined soldier bug (*Arma spinosa*, Dallas) devours the worms bodily, and is very serviceable in thinning the numbers.

There are also several of the *Hymenoptera*, which in the larva state live internally upon them, producing four-winged flies, some very small (*Miciogaster*), others quite large, as the yellowish brown Ichnumeon, (*Paniscus geminatus*, Say.)

Poultry, particularly chickens, are also an efficient help in destroying them.

ARTIFICIAL.—In order to keep cut-worms in check by artificial means, a knowledge of their habits is essential. Thus we know that they always feed at night, and in the day time conceal themselves under, but near the surface of the ground, in the immediate vicinity of the plants they have attacked. A slight search is sure to reveal them, and when found they are of course easily destroyed. This, though troublesome, is the most efficacious mode of preventing their ravages.

Ashes and lime spread around the plants have been recommended, but their usefulness is questionable. Soot seems to be more obnoxious to them. Fall ploughing is also supposed to be a remedy, and has been extensively practised, but it must be done very late in the season, when the worms are benumbed with cold, otherwise they will again descend into the soil to the depth necessary for their protection from the winter.

A curious fact in the history of these worms, is, that they cannot crawl up a perpendicular bank of earth. This fact has been utilized against them, and many have been entrapped in smooth holes made with a stick around the hills of corn or other plants infested by them. Another plan is to strike a single deep furrow with the plough around the field or garden to be protected, with the land side made perpendicular and without breaks, thus forming a barrier which they cannot surmount and preventing them from entering from the adjacent land.

Against the climbing cut-worms, vigilance is the main requirement for success. They also feed at night, and many may be picked off the trees after dark, with the help of a lantern. Some other plans have been devised, which are easily tried, and are so lucidly explained by Mr. Riley, that I add his remarks in full:—

"From the orchard planted upon light, warm soils, they can be driven away entirely by claying the ground about the trees; a wheelbarrow full is well nigh enough for each tree when spread around its base and as far as the limbs extend. This is the most thorough and lasting. A small strip of tin, three inches wide, carefully secured around the body of the tree, will effectually prevent their ascension; if the tin is old and rusty it will require to be a little wider. Each night, after the swelling of the bud, an hour or two after midnight a slight jar of the tree will bring every one on it down, when they can be caught in a spread sheet and destroyed. This will have to be followed up till the bud has unfolded into the leaf, after which there is no longer anything to be apprehended from the worm. The reasons why the clay is so efficient, are two-fold: 1st. The worms seem to have an instinctive dislike to crawling over it; 2nd. In dropping from the tree on to the hard surface they are frequently disabled, and whether disabled or not, they cannot immediately burrow into it as into sand, and they are all the more exposed to their numerous midnight enemies, which are ever watching for them."

SPIDERS.

By the Rev. C. J. S. Bethune.

[In the following paper, the writer lays no claim whatever to any originality; he has simply endeavoured to compile from various sources an account of the natural history of spiders that, he trusts, may afford interesting information to the general reader. The books from which he has mainly drawn his information are Emerton's "Structure and Habits of Spiders," (Salem, Mass., 1878); Rev. J. G. Wood's "Illustrated Natural History;" Kirby & Spence's "Entomology;" and Moggridge's "Harvesting Ants and Trap-Door Spiders." The illustrations are all reproductions of the wood-cuts in Emerton's excellent work, for permission to use which he is indebted to the publisher, Mr. S. E. Cassino, of Salem.]

1.—Introductory.

What is a Spider? is the first question that naturally arises when we begin to talk about the life-history of the class. Most persons would probably reply at once that a spider is an insect. This is undoubtedly correct in the popular acceptation of the term insect, and also accords with the derivation of the word (Latin — *in* and *seco*, I cut), signifying an animal whose body is divided into two or more segments almost entirely detached from each other. Spiders, however, are not true insects, though they belong to the same great division of the animal kingdom called the *Articulata*. As we stated in a former Report (1872, "Beneficial Insects," page 427), insects are distinguished by the following characteristics:—1st. They have their bodies divided into *segments*. 2nd. They breathe through openings in their sides *(spiracles)* from which proceed *tracheæ* or wind-pipes. 3rd. They have distinct heads, with jointed *antennæ*, or feelers. 4th. When adult they have *six articulated legs*. 5th. They go through a series of metamorphoses, ending in a *winged* state. A spider differs from an insect in almost all these particulars· 1st. It is divided into only *two* segments. 2nd. It breathes, as a rule, through *sacs in the abdomen*. 3rd. It has no distinct head separate from the thorax, and possesses no *antennæ*. 4th. It has *eight* articulated legs. 5th. It undergoes no distinct metamorphoses, and never attains wings. On all these accounts, then, we cannot scientifically call a spider an insect, though it is often convenient to use the term in ordinary conversation. A spider technichally belongs to the class Arachnida, which includes also the scorpions and mites; from the two latter orders it is distinguished especially by its spinning organs and its faculty of making cobwebs and silk cocoons for its eggs.

2.—ANATOMY.*

The common round-web spider, *Epeira vulgaris*, Hentz, will serve as well as any other species to show the anatomy of spiders in general. Figure 7 shows the under side of the spider; Figure 10 the upper side; and Figure 11 an imaginary section through the body, to show the arrangement of the internal organs. To begin with Figure 7, the body is seen to be divided into two parts connected only by the marrow joint, A, just behind the last pair of legs. The front half of the body, called the *Thorax*, contains the stomach, the central part of the nervous system, and the large muscles which work the legs and jaws. The hinder half, the *Abdomen*, contains the intestine, the breathing organs, the principal circulating-vessels, the organs of reproduction, and the spinning-organs. Connected with the thorax are six pairs of limbs, four pairs of legs, B B B B, a pair of palpi, C, and a pair of mandibles, D.

The *Legs* are used chiefly for running, jumping and climbing; but the front pair serve often as feelers, being held up before the body, while the spider walks steadily enough on the other six. One or both of the hinder legs are used to guide the thread in spinning; the spider at the same time walking or climbing about with the other six or seven. The legs are seven-jointed; and on the terminal joints are three claws, Fig. 8, A, B, C, and various hairs and spines. In many spiders a brush of hairs takes the place of the middle claw, as in the jumping-spiders, Fig. 9. Spiders with these brushes on their feet are able to walk up a steep surface or under a horizontal one, better than those with three claws. The legs of most spiders have amongst the hairs moveable spines, which, when the spider is running about, extend outward at a right angle with the leg, and when it is resting are closed against the skin.

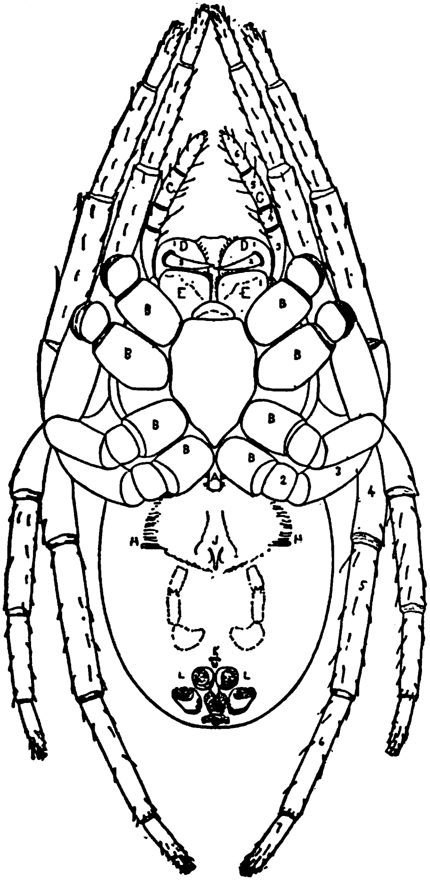


Fig. 7.

In front of the legs are the *Palpi*, Fig. 7, C C,—a smaller pair of limbs, with six joints, and only one claw, or sometimes none. They are used as feelers, and for handling food, and in

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* As the writer has stated at the outset that this paper is merely a compilation, he does not think it necessary to indicate by quotation marks, or otherwise, those portions that are taken verbatim from the authors referred to. Those who are familiar with their works will have no difficulty in verifying the passages should they desire to do so.

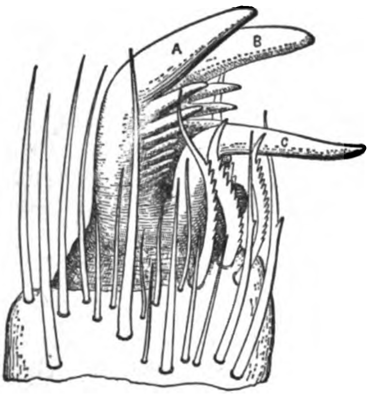


Fig. 8.

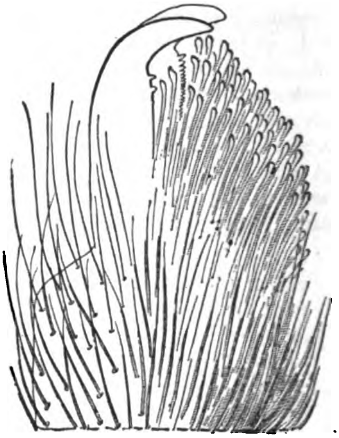


Fig. 9.

the males carry the very curious palpal organs, which are employed in the fertilization of the female. The basal joints, Fig. 7, E E, of the palpi are flattened out, and serve as chewing organs, — they are called *maxillæ*.

The front pair of limbs, the *Mandibles*, Fig. 7, D D, have two joints, the basal one is usually short and stout, and furnished on the inner side with teeth and hairs; the other is a small, sharp claw, which can be closed against the basal joint when not in use. (See also Figures 19 and 20.)

The *Abdomen*, or hinder half of the body, is furnished, just behind the legs, with two hard, smooth patches, which cover the front pair of breathing-organs, the openings to which are two little slits at Fig. 7, H. At the end of the body are the spinnerets, which will be described further on. There are three pairs of them; but many spiders close them together when not in use, so as to cover up the middle pair. Sometimes the third pair of spinnerets have several joints and extend out behind the body like two tails. In front of the spinnerets is a little opening, Figure 7, K, which leads to air-tubes that give off branches to different parts of the abdomen. At M, Figure 7, are usually two coloured bands, or rows of spots, marking the course of muscles attached to the skin at various points along these lines.

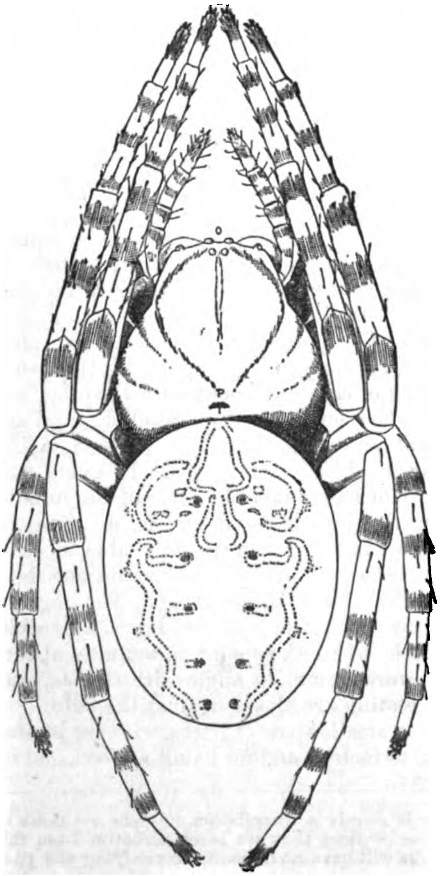


Fig. 10.

Let us now turn to figure 10, which represents the upper surface, or back of the same spider. The head is not separated from the rest of the body, as in insects, but forms one piece with the thorax. On the front of the head are eight simple eyes, O, which are differently arranged in different spiders. At the back of the thorax is a groove, P, under which is attached a muscle for moving the sucking stomach, Figure 11, D. From this point radiate shallow grooves, that follow the divisions between the muscles of the legs. On the abdomen are several pairs of dark smooth spots which mark the ends of muscles extending downward through the abdomen. The markings of this spider are very complicated. The spot on the middle of the front of the abdomen is a very common one, and in some spiders extends the whole length of the body. The waved lines on each side are also common, and in long-bodied spiders often form two bright-coloured stripes, or rows of spots, running nearly straight the whole length of the abdomen.

The following illustration, Figure 11, will convey to the reader a sufficient idea of the arrangement of the internal organs of a spider, without any more detailed description.

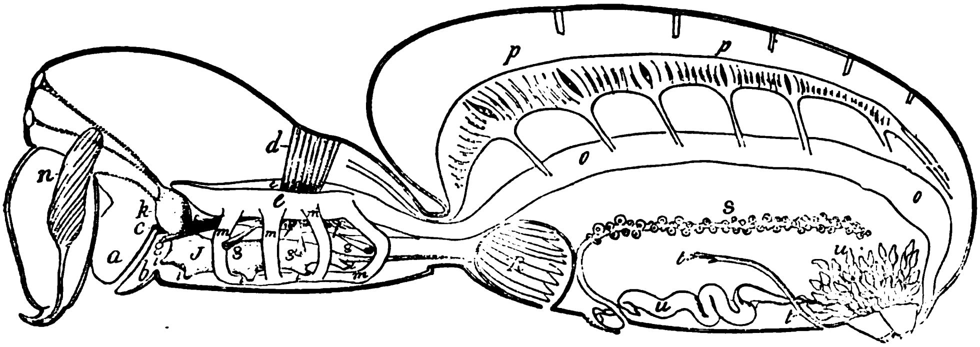


Figure 11.

Section of a spider to show the arrangement of the internal organs; *a*, *b*, upper and under lips of the mouth; *c*, *c*, the œsophagus; *d*, *f*, upper and under muscles of the sucking stomach; *e*, stomach; *g*, *g*, ligaments attached to diaphragm under the stomach; *f*, lower nervous ganglion; *k*, upper ganglion; *l l*, nerves to the legs and palpi; *m*, branches of the stomach; *n*, poison gland; *o*, intestine; *p*, heart; *R*, air-sac; *S*, ovary; *t*, air-tube; *u*, spinning-glands.

3.—Classification.

To enter into a minute account of the classification of the Arachnida would be very tedious, and occupy an undue amount of space. We shall therefore content ourselves with mentioning some of the more important families of spiders, and describe some of their characteristics.

The largest known spiders belong to the family *Mygalidæ*. They may be at once distinguished by the shape of their mandibles and the terrible claws which proceed from them. In most spiders the claws are set sideways (as in *Epeira* Figure 7, D.), but in this family they are bent downwards, and strike the prey as a lion would clutch his victim with his curved talons. The body is usually very hairy and dark-coloured. Most species have only four spinnerets, one pair of which are long and are turned up behind the abdomen; they have four air-sacs under the front of the abdomen, instead of two, as other spiders. The eyes are collected together on the front of the head. They live only in warm countries. Figure 12 represents *Mygale Hentzii*, a species found in Texas and Arizona. Many wonderful stories have been told about the ferocity of these huge spiders, their power of catching and eating small birds and other animals. These accounts were generally discredited and looked upon as mere "travellers' tales," but of late years fresh evidence has been produced by naturalists in proof of the former stories. The following description by Mr. H. W. Bates in his interesting work, "The Naturalist on the River Amazon," (page 83), sets forth the truth regarding these monsters:—

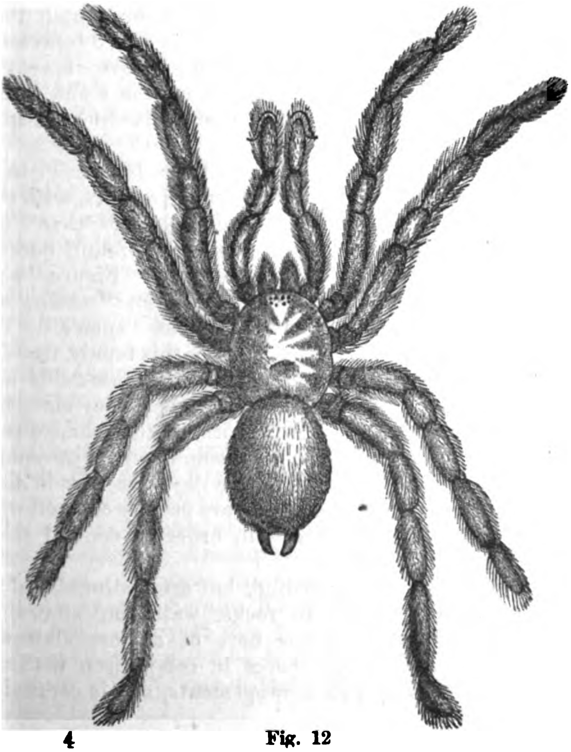


Fig. 12

"At Cameta," he relates, "I chanced to verify a fact relating to the habits of a large hairy spider of the genus Mygale, in a manner worth recording. The individual was nearly two inches in length of body, but the legs expanded seven inches, and the entire body and legs were covered with coarse grey and reddish hairs. I was attracted by a movement of the monster on a tree-trunk, it was close beneath a deep crevice in the tree, across which was stretched a dense white web. The lower part of the web was broken, and two small birds, finches, were entangled in the pieces. One of them was quite dead, the other lay under the body of the spider not quite dead, and was smeared with the filthy liquor or saliva exuded by the monster. I drove away the spider and took the birds, but the second one soon died. I found the circumstance to be quite a novelty to the residents hereabouts. The Mygales are quite common insects; some species make their cells under stones, others form artistic tunnels in the earth, and some build their dens in the thatch of houses. The natives call them crab spiders. The hairs with which they are clothed come off when touched and cause a peculiar and almost maddening irritation. Some Mygales are of immense size. One day I saw the children belonging to an Indian family who collected for me, with one of these monsters secured by a cord around its waist, by which they were leading it about the house as they would a dog!"

Other writers relate that the spiders of this family attack humming-birds, lizards, cockroaches, ants, etc.

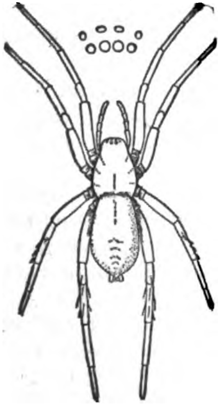


Fig. 13.

The *Dysderidæ* constitute a small family of spiders which are chiefly remarkable for possessing only six eyes, instead of the normal number of eight. They are usually found under stones or in holes in the earth; they lie with their legs drawn up under them, but are able to move very quickly when so inclined. Very few species are known and none are common in America; a few have been observed in Europe.

The family of the *Drassidæ* is spread over the greater part of the world; they vary very much in shape, colour and habits. Most of them are dull coloured, while they all have the habit of concealing themselves in silken cells that they construct under stones, in chinks of walls, or on plants. They are active creatures, and catch their prey by chasing them, as they construct no webs. Figure 13 represents a species of *Drassus;* the double row of circles above represents the mode in which the eight eyes are arranged on the front of the head. Their feet have two claws and a bunch of flat hairs: the spinnerets usually project a little beyond the abdomen.

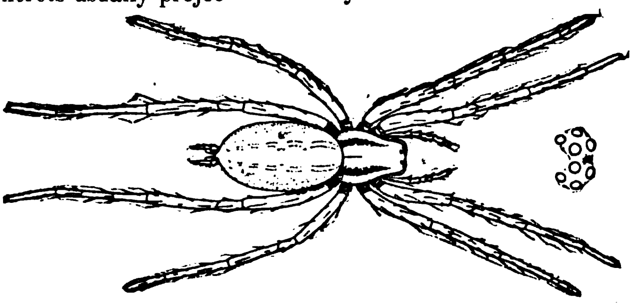


Fig. 14.

The *Agalenidæ* are long-legged, brown spiders, with two spinnerets longer than the others and extending out behind the body. Figure 14 represents *Agalena nœvia*, the common grass spider. The members of this family are very numerous on grass-fields and commons, where they made flat webs with a funnel-shaped tube on one side in which the spider waits, see figure 23. Many of the species are prettily marked; they lay their eggs in dish-shaped cocoons, which are attached to grass or other herbage, and are usually covered with little bits of dead leaves, pieces of earth and other substances in order to conceal them from enemies.

The next family, *Ciniflonidæ*, much resemble the preceding, but are distinguished by their peculiar spinning organs. They live in crevices in rocks, walls and stones, or under loose bark, and near their hiding-place they weave nets of a most elaborate structure, not flat like garden-spiders but enclosing large spaces in comparison with the small size of the builder. The web is most intricate in its arrangements, and is connected with the hiding-place of the spider by means of a silken tunnel, through which the creature darts when it feels the vibration of an insect in its web, and to the bottom of which it retreats when danger threatens. The species of this family are very numerous, building their webs on stone buildings, often to their great disfigurement, in cellars, the corners of windows, &c. They are, no doubt, familiar to every observer.

The *Lycosidæ*, or Wolf-spiders, live on the ground and take their prey in fair chase, instead of catching it in webs. They are mostly found among herbage, low bushes, fallen leaves, and similar localities, and if they should feel alarmed, they run for safety under stones, mosses, rocks, and into any accidental crevice in the earth. They are fierce and determined hunters, chasing their prey wherever it may seek shelter. Some of them are semi-aquatic in their habits, and are not only able to run fearlessly upon the surface of the water, but can descend along the aquatic plants until they are deeply immersed, breathing by means of the air which is entangled among the hairy clothing of their bodies. They have long legs, the hind pair being the longest; the head is high, and the eyes are arranged in a peculiar manner, as shown at the bottom of Fig. 15, which represents a species of *Lycosa*.

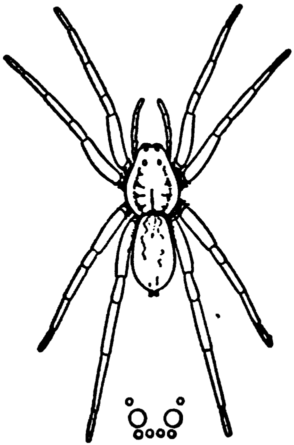


Fig. 15.

The celebrated Tarantula spider belongs to this genus. It is so called from the town of Tarentum, in Italy, where it is very common. There was a deeply rooted belief among the inhabitants of that town and neighbourhood that if any one were bitten by this spider, he would be instantly afflicted with an extraordinary disease called tarentismus, which exhibited itself in one of two extremes, the one being a profound and silent melancholy, and the other a continual convulsive movement of the whole body. It was also thought that this disease could only be cured by music, and that a certain tune was needful in each particular case. The disease undoubtedly existed and spread with great rapidity through the neighbouring towns and villages, affecting hundreds of both sexes who came within the sphere of its influence, but the poor Tarantula spider had no more to do with it than the cattle grazing in the fields or the birds chirping in the trees. It was evidently a nervous disease like chorea and hysteria at the present day, which tends to propagate itself among all exposed to its influence.

Another species of *Lycosa* frequents dry and uncultivated soils, and sinks in the ground a little pit of a depth varying with its size and the length of its residence. The interior of the cell it strengthens with a web. At the entrance of this burrow it sits watching for its prey, and as soon as an unfortunate insect passes within range, it darts forward, seizes it in its talons, and bears the victim away to its den, where it feasts in peace and solitude.

The females of this genus are extremely fond of their eggs and young. The eggs are enveloped in silken cocoons of a globular form, which the mother always drags about with her, bumping them over stones and rough ground without injury to the delicate organisms within. As soon as the young are hatched and emerge from the cocoon, they transfer themselves to the body of their parent, where they cling in such numbers that sometimes she is hardly visible under her swarming brood. They remain with their mother during the winter, and in the following spring disperse to seek their own living.

The *Attidæ*, or jumping spiders, are the next on our list of families. The body is usually short and the head square. The arrangement of the eyes is very peculiar, as they are set on the head in the form of a semi-circle, with two very large eyes in the middle of the curve; this give the spiders of this family a much more animated look than is usual among the Arachnida. The legs are short, the front pair being often stouter than the others. They can run easily backwards or sideways as well as forwards, and jump a long distance. Figure 16 represents the common grey jumping spider *(Salticus)* much magnified. Many of this family of spiders are very common; they are usually found upon walls, among stones, or under leaves; a sunny window-sill is also a favourite locality for them. When one of them sees a fly, or other insect, which it wishes to devour, it sidles along quietly in the direction of its intended victim, keeping a most careful watch, and ever drawing nearer to its prey. As the fly moves, so moves the spider, until the two appear to be animated by one common will. Slowly, but surely, it makes its way towards the unsuspecting fly, and then with a leap so quick that the eye can scarcely follow the movement, it springs upon its prey, rolls perhaps over and over, and in a few moments emerges victorious from the contest, its victim dead or dying in its grasp. Even on a perpendicular wall the spider will make these leaps. It is sure not to fall to the ground as it always draws a silken cord behind it as it moves, and so, whenever it leaps upon its prey, it is able to mount up again to its former post.

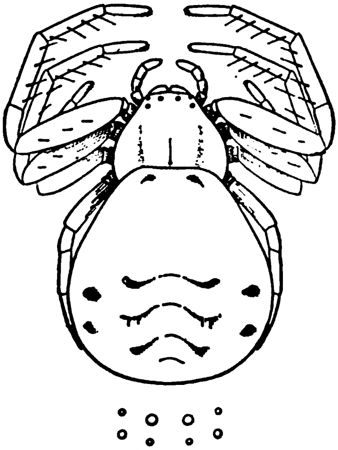


Fig. 17.

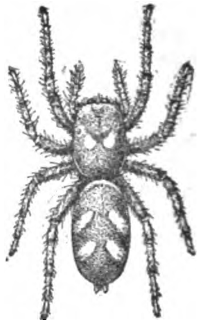


Fig. 16.

The family *Thomisidæ*, or Crab-spiders, are like the preceding, dependent for their subsistence upon their bodily powers and activity. The body is usually flat, and wide behind. The front two pair of legs are longer than the others, and so bent that the spider can use them when in a narrow crack. Some of them, like crabs, walk better sideways than forwards. Like the running and jumping spiders, they make no webs for catching food. Fig. 17 represents a species of *Thomisus*, showing at the bottom of the cut the arrangement in two rows of the eight small eyes. As in many other families of spiders, the males are very much smaller than the females.

The next family, *Theridiidæ*, contains the largest number of species, but the spiders comprising it are usually small, with large rounded abdomens and slender legs. They usually live upside down, holding on by their feet to the underside of their webs, as in fig. 18, which represents the common house *Theridion*, much enlarged. They make large cobwebs of different shapes for different species, and depend for food on what is caught in them. They are found in all parts of the world, and vary very greatly in their habits. Some live under stones, others are abundant in houses, hiding themselves in shady corners, while the greater number prefer the open air, the fields and commons, spinning their elaborate webs over the bushes, trees, or herbage. Their appearance and habits must be familiar to every one.

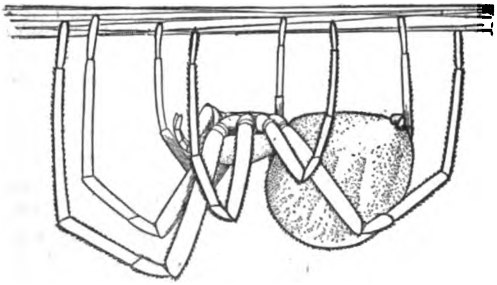


Fig. 18.

The last family on our list is the *Epeiridæ*, or round-web spiders; it contains some of the strangest members of the race. The individuals are usually large, with flat heads, and eyes wide apart, and with short round abdomens. The upper and under surfaces of a common species, *Epeira vulgaris*, are represented in figs. 7 and 10. They make webs formed of radiating lines crossed by other adhesive ones in a spiral or in concentric loops, as in fig. 24. They live in the web, hanging head downwards, or upside down in a hole near by. The webs are usually stretched perpendicularly from branch to branch of a tree, or in the angles of verandahs, fences and other outdoor localities.

4.—Biting Apparatus.

Almost every one, we imagine, looks upon spiders with a certain degree of abhorrence on account of the supposed poisonous character of their bite, and the ferocious, bloodthirsty disposition ascribed to them. The popular opinion regarding them is, no doubt, immensely exaggerated; they do, of course, possess a biting apparatus and a poison gland that we shall presently describe, but we do not think they are at all inclined to make use of these except against their natural prey, viz., flies and other insects. Though we have often been shewn marks and swellings on the limbs of children that mothers and nurses ascribe to spiders, we have never caught a spider in the act of attacking a child, nor have we found that others have done so. While we do not for a moment deny that spiders may attack human beings, we should like a little more direct evidence before we condemn the whole race.

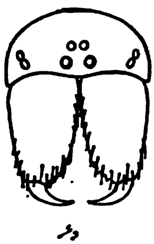


Fig. 19.

The biting apparatus is shewn in fig. 19, which represents the head and mandibles of *Epeira vulgaris*, seen from in front. When not in use, the claw is closed up against the mandible between the rows of teeth; but, when the jaws are opened to bite, the claws are turned outward, so that their points can be stuck into anything between the jaws. Fig. 20 is the claw still more enlarged, shewing a little hole near the point at *a*, out of which is discharged the poisonous secretion of a gland in the head, fig. 11, *n*. The ordinary use of the mandibles is for killing and crushing insects, so that the soft parts can be eaten by the spider; and in this they are aided by the maxillæ, fig. 7, *e*. They will sometimes chew an insect for hours, until it becomes a round lump of skin, with all the blood sucked out of it; this is then thrown away, the spider swallowing only such bits as may happen to be sucked in with the liquid portion.

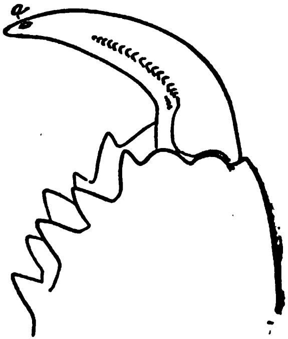


Fig. 20.

"If let alone"—to quote Emerton—"no spiders bite anything except insects useful for food; but, when attacked and cornered, all species open their jaws and bite if they can; their ability to do so depending on their size and the strength of their jaws. Notwithstanding the number of stings and pimples that are laid to spiders, undoubted cases of their biting the human skin are very rare; and the stories of death, insanity and lameness from spider-bites, are probably all untrue."

On the opposite side we may quote the Rev. J. G. Wood, who says: "I can state from personal experience that the bite of an angry spider inflicts a really painful injury, not very dissimilar to the sting of a wasp. I have seen a lady's hand and arm swollen so as to be hardly recognizable as belonging to the human figure, in consequence of a bite inflicted by a large spider on the back of her hand."

Many experiments have been tried to test the effect of the bites of spiders on animals. Doleschall shut up small birds with two species of Mygale, both large and strong spiders (see fig. 12); and the birds died in a few seconds after being bitten. One of the spiders was left for ten days without food, and then made to bite another bird, which was injured, but in six hours recovered. The same author was bitten in the finger by a jumping spider. The pain was severe for a few minutes, and was followed by lameness of the finger and gradually of the hand and arm, which soon went away entirely.

Bertkau allowed spiders to bite his hand. On the ends of the fingers the skin was too thick, but between the fingers they easily pierced it. The bite swelled and smarted for a quarter of an hour, and then itched for some time, and for a day after itched whenever rubbed, as mosquito bites will. He also experimented on flies, which died in a few minutes after being bitten.

Mr. Blackwall, to test the poison of spiders, made several large ones bite his hand and arm, and at the same time pricked himself with a needle. Although the spiders bit deep enough to draw blood, the effect of their bite was exactly like that of the prick of the needle. No inflammation or pain followed, and both healed immediately.

Several spiders were placed together, and made to bite one another. The bitten ones lived always some hours, and died from loss of blood; and one spider, that had been bitten in the abdomen so that some of the liver escaped and dried on the outside, lived over a year, apparently in good health.

A large spider was made to bite a wasp near the base of the right front wing, so as to disable it; but it lived thirteen hours.

A bee was bitten by a large spider, but lived three days.

A grasshopper was bitten, and held in the jaws of a spider for several seconds; but it lived in apparent health for two days.

Insects of the same kind were wounded in the same places with needles, and died in about the same time as those bitten. From these experiments Mr. Blackwall was led to believe that the secretion from the spider's jaw is not poisonous, but that insects die, when bitten, from loss of blood and mechanical injury.

Dufour kept a Tarantula that soon learned to take flies from his fingers without biting him. Spiders of very different species may soon be taught to take food from the hand or a pair of forceps, or water from a brush, and will come to the mouth of their bottle and reach after it on tip-toe. Many stories are also told of spiders coming out of their holes to listen to music, and of their being taught to come out and take food at the sound of an instrument.

We may quote here the account of an observer of what a spider can eat in a day:—

'In order to test what a spider can do in the way of eating, we arose about daybreak in the morning to supply his fine web with a fly. At first, however, the spider did not come from his retreat, so we peeped among the leaves, and there discovered that an earwig had been caught and was now being feasted on. The spider left the earwig, rolled up the fly, and at once returned to his "first course." This was at half-past five a.m. in September. At seven a.m. the earwig had been demolished, and the spider, after resting a while, and probably enjoying a nap, came down for the fly, which he had finished at nine a.m. A little after nine we supplied him with a daddy-long-legs, which he ate by noon. At one o'clock a blowfly was greedily seized, and then immediately, with an appetite apparently no worse for his previous indulgence, he commenced on the blowfly.'

5.—SPINNING APPARATUS.

That, which more than anything else, distinguishes spiders from other animals is the habit of spinning webs. Some of the mites spin irregular threads on plants, or cocoons for their eggs; and many insects spin cocoons in which to pass through the change from larva to adult. In the spiders, the spinning organs are much more complicated and used for a greater variety of purposes,—for making egg-cocoons, silk linings to their nests, and nets for catching insects. The spider's thread differs from that of insects, in being made up of a great number of finer threads laid together while soft enough to unite into one.

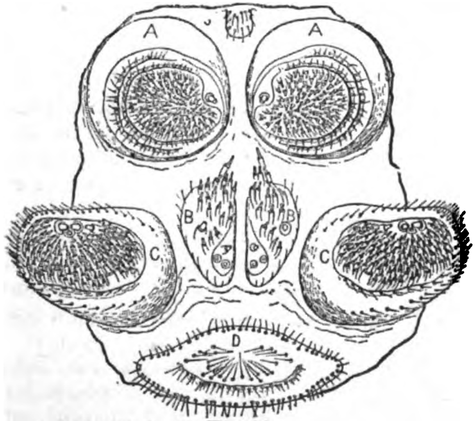


Fig. 21.

The external spinning-organs are little two-jointed tubes on the ends of the spinnerets, Fig. 7, L. Fig. 21 represents the spinnerets of the same spider, still more enlarged to shew the arrangement of the tubes. There is a large number of little tubes on each spinneret, and in certain places a few larger ones. Each tube is the outlet of a separate gland.

When the spider begins a thread it presses the spinnerets against some object, and forces out enough of the secretion from each tube to adhere to it. Then it moves the spinnerets away; and the viscid liquid is drawn out and hardens at once into threads,—one from each tube. If the spinnerets are kept apart a band of threads is formed; but if they are closed together the fine threads unite into one or more larger ones. If a spider is allowed to attach its thread to glass, the end can be seen spread out over a surface as large as the ends of the spinnerets, covered with very fine threads pointing towards the middle where they unite. The spinning is commonly helped by the hinder feet, which guide the thread and keep it clear of surrounding objects, and even pull it from the spinnerets. This is well seen when an insect has been caught in a web, and the spider is trying to tie it up with threads. She goes as near as she safely can, and draws out a band of fine threads, which she reaches out toward the insect with one of her hind feet; so that it may strike the threads as it kicks, and become entangled with them. As soon as the insect is tied tightly enough to be handled, the spider holds and turns it over and over with her third pair of feet, while with the fourth pair, she draws out, hand over hand, the band of fine threads which adhere to the insect, as it turns, and soon cover it entirely.

It is a common habit with spiders to draw out a thread behind as they walk along; and in this way they make the great quantities of threads that sometimes cover a field of grass or the side of a house. We often see the points of all the pickets of a fence connected by threads spun in this way by spiders running down one picket and up the next, for no apparent purpose.

Spiders often descend by letting out the thread to which they hang; and are able to control their speed, and to stop the flow of thread at will. They sometimes hang down by a thread, and allow themselves to be swung by the wind to a considerable distance, letting out the thread when they feel they are going in the right direction.

Spiders in confinement begin at once to spin, and never seem comfortable till they can go all over their box without stepping off their web. The running spiders, that make no other webs, when about to lay their eggs, find or dig out holes in sheltered places, and line them with silk. Species that live under stones or on plants, all line their customary hiding-places with web to which they hold when at rest. Several of the large running spiders dig holes in sand, and line them with web, so that the sand cannot fall in; and build around the mouth a ring of sticks and straws held together by threads.

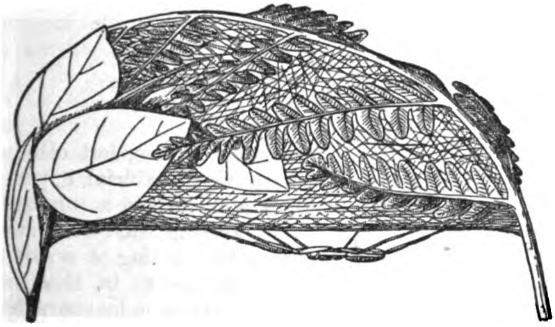


Fig. 22.

Some spiders make a great, irregular nest constructed of grass and leaves drawn together with silken threads. Fig. 22 represents a nest of this kind made by a *Dolomedes*: it is four or five inches in diameter and contains the egg-cocoon. The young hatch and ramble about in this nest for some time; the parent spider remains near, usually holding on under the nest, as represented in the illustration.

6.—Cobwebs.

The simple nests and tubes that have been already mentioned are, for the most part, made by spiders which spin no other webs. The larger and better known cobwebs for catching insects are made by comparatively few species. On damp mornings in summer the grass-fields are seen to be half covered with flat webs, from an inch or two to a foot in diameter, which are considered by the weatherwise as signs of a fair day. These webs remain on the grass all the time, but only become visible from a distance when the dew settles on them. Fig. 23 is a diagram of one of these nests, supposed, for convenience, to be spun between pegs instead of grass. The flat part consists of strong threads from peg to peg, crossed by finer ones, which the spider spins with the long hind-spinnerets, swinging them from side to side and laying down a band of threads at each stroke. At one side of the net is a tube leading down among the grass-stems. At the top the spider usually stands, just out of sight, and waits for something to light on the web, when she runs out and snatches it, and carries it into the tube to eat. If anything too large walks through the web, she turns round and retreats out of the lower end of the tube, and can seldom be found afterwards. In favourable places these webs remain through the whole season, and are enlarged, as the spider grows, by additions on the outer edges, and are supported by threads running up into the neighbouring plants.

Similar webs are made by several house-spiders, the mode of construction of which is thus described by Kirby and Spence:—

"The weaving spider which is found in houses, having selected some corner for the site of her web, and determined its extent, presses her spinners against one of the walls, and thus glues to it one end of her thread. She then walks along the wall to the opposite side, and there in like manner fastens the other end. This thread, which is to form the outer margin or selvage of her web, and requires strength, she triples or quadruples by a repetition of the operation just described; and from it she draws other threads in various directions, the interstices of which she fills up by running from one to the other, and connecting them by new threads until the whole has assumed the gauze-like texture which we see.

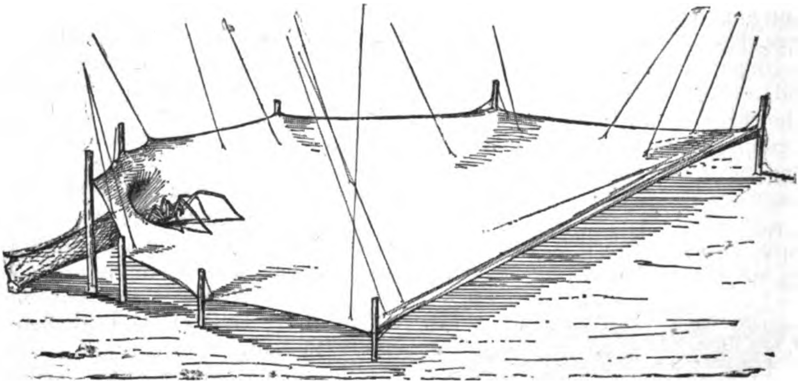


Fig. 23.

"The webs just described present merely a simple horizontal surface, but others more frequently seen in out-houses and amongst bushes possess a very artificial appendage. Besides the main web, the spider carries up from its edges and surface a number of single threads, often to the height of many feet, joining and crossing each other in various directions. Across these lines, which may be compared to the tackling of a ship, flies seem unable to avoid directing their flight. The certain consequence is, that in striking against these ropes they become slightly entangled, and, in their endeavours to disengage themselves, rarely escape being precipitated into the net spread underneath for their reception, where their doom is inevitable.

"But the net is still incomplete. It is necessary that our hunter should conceal her grim visage from the game for which she lies in wait. She does not, therefore, station herself upon the surface of her net, but in a small silken apartment constructed below it, and completely hidden from view. 'In this corner,' to use the quaint translation of Pliny by Philemon Holland, 'with what subtiltie does she retire, making semblance as though she meant nothing less than that she doth, and as if she went about some other business! nay, how close lieth she, that it is impossible to see whether any one be within or no!' But thus removed to a distance from her net and entirely out of sight of it, how is she to know when her prey is entrapped? For this difficulty our ingenious weaver has provided. She has taken care to spin several threads from the edge of the net to that of her hole, which at once inform her by their vibrations of the capture of a fly, and serve as a bridge on which in an instant she can run to secure it."

These webs, if let alone, are repeatedly enlarged till they are a foot or two wide, and remain till they collect dust enough to tear them down by its weight.

Many spiders that make cobwebs live under them, back downwards, and many are so formed that they can hardly walk right side up. The webs of *Theridion* (Fig. 18), usually have at some part a tent or thicker portion under which the spider stands, and from this run irregularly simple threads, crossing each other in all directions and held in place by threads above and below. Such loosely constructed webs are often made in houses, in corners of rooms, under furniture and in cellars. The same spider occasionally spins out of doors on fences, but never on plants. When it has caught an insect and tied it up, it gradually hoists it up into its nest, sometimes a considerable distance.

7.—GEOMETRICAL WEBS.

These familiar structures are the work of the family *Epeiridæ* (Figs. 7 and 10). The process of making them can be observed in any garden; it is, of course, very different from that described above in the construction of cobwebs. The net is usually fixed in a perpendicular or somewhat oblique direction, in an opening between the leaves or branches of some shrub or plant, in a window-frame or fence, or some such open wooden structure, where there is a hole or crack in which they can hide when necessary.

"It is obvious," to quote Kirby and Spence's description, "that round the whole extent of the net, lines will be required to which can be attached those ends of the radii that are furthest from the centre. Accordingly the construction of these exterior lines is the spider's first operation. She is careless about the shape of the area which they enclose, but is guided by the distance or proximity of the points to which she can attach them. She spares no pains, however, to strengthen and keep them in a proper degree of tension. With the former view she composes each line of five or six or even more threads glued together; and with the latter she fixes to them from different points a numerous and intricate apparatus of smaller threads. Having thus completed the foundations of her snare, she proceeds to fill up the outline. Attaching a thread to one of the main lines, she walks along it, guiding it with one of her hind feet that it may not touch in any part and be prematurely glued, and crosses over to the opposite side, where, by applying her spinners, she firmly fixes it. To the middle of this diagonal thread, which is to form the centre of her net, she fixes a second, which in like manner she conveys and fastens to another part of the lines encircling the area. Her work now proceeds rapidly. During the preliminary operations she sometimes rests, as though her plan required meditation. But no sooner are the marginal lines of her net firmly stretched, and two or three radii spun from its centre, than she continues her labour so quickly and unremittingly that the eye can scarcely follow her progress. The radii, to the number of about twenty, giving the net the appearance of a wheel, are speedily finished. She then proceeds to the centre, quickly turns herself round, and pulls each thread with her feet to ascertain its strength, breaking any one that seems defective and replacing it by another. Next, she glues immediately round the centre five or six small concentric circles, distant about half a line from each other, and then four or five larger ones, each separated by a space of half an inch or more. These last serve as a sort of temporary scaffolding to walk over, and to keep the radii properly stretched while she glues to them the concentric circles that are to remain, which she now proceeds to construct. Placing herself at the circumference, and fastening her thread to the end of one of the radii, she walks up that one, towards the centre, to such a distance as to draw the thread from her body of a sufficient length to reach to the next; then stepping across, and conducting the thread with one of her hind feet, she glues it with her spinners to the point in the adjoining radius to which it is to be fixed. This process she repeats until she has filled up nearly the whole space from the circumference to the centre with concentric circles, distant, from each other about two lines. She always, however leaves a vacant interval around the smallest first spun circles that are nearest to the centre. Lastly, she runs to the centre and bites away the small cotton-like tuft that united all the radii, which being now held together by the circular threads, have thus probably their elasticity increased; and in the circular opening resulting from this procedure, she takes her station and watches for her prey."

Some species, however, do not entirely surround the radii of their nets with concentric circles, but leave one radius free, which serves as a sort of ladder for access to the net. Others, again, spin spiral lines from the centre to the circumference, as shewn in Fig. 24. In this case, when the radii are finished, the spider begins at the centre to spin a spiral line across them, *a*, *a*, *a*, in Fig. 24; the turns of the spiral being as far apart as the spider can conveniently reach. She climbs from one radius to the next, holding her thread carefully off with one of the hind-feet till she gets to the right point, and then turns up her abdomen and touches the radius with her spinnerets, thus fastening the cross-threads to it. The figure shows her in this position. When this spiral has been carried to the outside of the web, she begins there another and closer one of thread of a different kind. While the first thread was smooth, the latter is

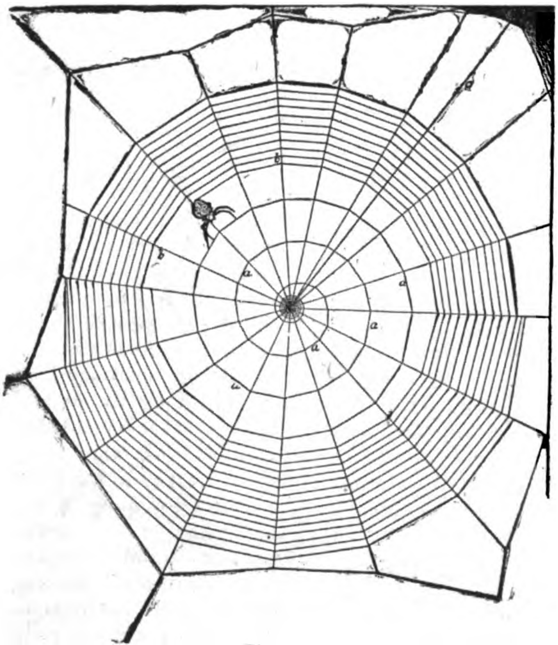


Fig. 24.

covered with a sticky liquid which soon collects on it in drops, and makes it adhere to anything that touches it. After going round a few times this spiral would come in contact with that first spun, but as the spider comes to the first she bites it away. By beginning thus at the outside, the spider is able to cover the whole web with adhesive threads, and, without stepping on it, take her usual place in the centre. She usually is careful enough to spin beforehand a thread from the centre to her nest, and sometimes stays there, with one foot on the thread, so as to feel if anything is caught in the web. When she feels a shake, she runs down to the centre, feels the rays to see where the insect is, and runs out, and seizes it, or ties it up as already described. We have described the web as consisting of one regular spiral; but this is seldom the case. It is usually wider on one side than the other, or below than above, as in Fig. 24, where outside the spirals are several loops going partly round the web. The web of Zilla consists entirely of such loops going three-quarters round the web, and returning, leaving a segment without any cross-threads, in which is the line from the centre to the spider's nest. Most of the *Epeiridæ* are brightly coloured, and make no attempt at concealment when in the web. Others have odd shapes and colours, and hang in the web in such positions that they look like anything but animals. Some species draw up their legs against their triangular abdomens, and look like bits of bark fallen into the web. Others are long and slender, and when at rest, either in the web or out, lay their legs close together before and behind their bodies, so as to look like straws. Others have oddly shaped abdomens under which the rest of the body is concealed.

As the spider stands in her web, and feels a slight shake, such as would be caused by a sudden wind, she draws her legs together, pulling the rays tighter, and so making the whole web steady. If, however, the spider is frightened, and has no time to escape, she throws her body back and forth as a man does in a swing, and thus shakes the web so rapidly, that the spider can hardly be seen. The most usual habit, when alarmed, is to drop to the ground, and lie there as if dead.

8.—FLYING SPIDERS.

Every-one has, no doubt, observed in summer and autumn long threads with one end attached to the bushes, and the other blowing out in the wind; or bits of cob-web (often termed "gossamer") carried along by the currents of air, with occasionally a little spider attached to them. To account for these, various fanciful theories have been invented. The old and very absurd notion was that gossamer was made of dew scorched by the sun! Others imagined that spiders were able to force the thread from their spinnerets, like water from a syringe, in any direction they chose.

If a spider be put on a stick surrounded by water, she manages in course of time to escape by means of a thread carried across to some object beyond. To find out how this was done, Mr. Blackwall tried some experiments. He put spiders on sticks in vessels of water, and they ran up and down, unable to escape as long as the air in the room was still. But, if a draught of air passed the spider, she turned her head toward it, and opened her spinnerets in the opposite direction. If the draught continued, a thread was drawn out by it, which at length caught upon something, when the spider drew it tight and escaped on it. If the air was kept still, or the spider covered with a glass, she remained on the stick till taken off.

These experiments have been repeated, and show that the spider does not shoot or throw the web in any way, but takes advantage of currents of air, and allows threads to be blown out to a considerable distance.

There is a still more curious use of this method of spinning threads; that is, in flying. Small spiders, especially on fine days in the autumn, get up on the tops of bushes and fences, each apparently anxious to get as high as possible, and there raise themselves up on tiptoe, and turn their bodies up, as in Fig 25, with their heads toward the wind, and spinnerets open. A thread soon blows out from the spinnerets, and, if the current of air continues, spins out to a length of two or three yards, and then offers enough resistance to the wind to carry the spider away with it up into the air. As soon as she is clear, the spider turns around, and grasps the thread with her feet, and seems to be very comfortable and contented till she strikes against something. Sometimes they rise rapidly, and are soon out of sight; at other times they blow along just above the ground.

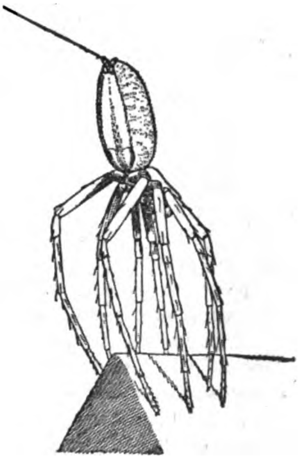


Fig. 25.

This habit is not confined to any particular kinds of spiders, but is practised by many small species of *Erigone*, and by the young of many spiders of all families, that when adult would be too large for it. The majority of spiders that fly in autumn are the young of several species of *Lycosa*, that seem to spend the greater part of October in trying to get as far above ground as possible. The best places to watch for them are garden-fences, where they often swarm, and can be seen more distinctly than on bushes.

It is still unexplained how the thread starts from the spinnerets. It has been often asserted that the spider fastens the thread by the end, and allows a loop to blow out in the wind; but in most cases, this is certainly not done, only one thread being visible. Sometimes, while a thread is blown from the hinder spinnerets, another from the front spinnerets is kept fast to the ground (fig. 26); so that when the spider blows away, it draws out a thread behind it entirely independent of the one from which it hangs. Sometimes, instead of a single thread, several are blown out at once, like a long brush.

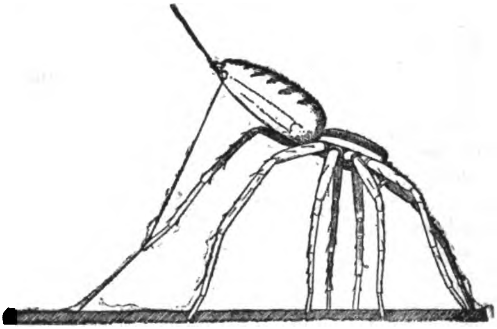


Fig. 26.

9.—WATER SPIDERS.

One of the most curious and interesting of the spider family is the *Argyroneta aquatica*, or Water-spider, which lives for the greater part of its life beneath the surface of water. Kirby and Spence give the following description of its habitation:—

"It is built in the midst of water, and formed, in fact, of air! Spiders are usually terrestrial, but this is aquatic, or rather amphibious; for though she resides in the midst of water, in which she swims with great celerity, sometimes on her belly, but more frequently on her back, and is an admirable diver, she not unfrequently hunts on shore, and having caught her prey, plunges with it to the bottom of the water. Here it is she forms her singular and unique abode. She would evidently have but a very uncomfortable time were she constantly wet, but this she is sagacious enough to avoid; and by availing herself of some well-known philosophical principles, she constructs for herself an apartment in which, like the mermaids and sea-nymphs of fable, she resides in comfort and security. The following is her process. First she spins loose threads in various directions attached to the leaves of aquatic plants, which may be called the frame-work of her chamber, and over them she spreads a transparent varnish resembling liquid glass, which issues from the middle of her spinners, and which is so elastic that it is capable of great expansion and contraction; and if a hole be made in it, it immediately closes again."

The next operation—that of filling the nest with air—is thus described by Mr. Bell (Journal of the Linnæan Society): "After the nest has been made as large as half an acorn, she goes to the surface, and returns (in the instance observed, as many as fourteen times successively), and each time brings down a bubble of air which she lets escape into her nest. The bubble is held by the spinnerets and two hind-feet, which are crossed over them, and is obtained in the following manner:—The spider climbs up on threads or plants nearly to the surface, and puts an end of the abdomen out of water for an instant, and then jerks it under, at the same time crossing the hind legs quickly over it. She then walks down the plants to her nest, opens her hind-feet, and lets the bubble go."

To go on with Kirby and Spence's account:—"In about a quarter of an hour she has transported as much air as suffices to expand her apartment to its intended extent, and now finds herself in possession of a little aërial edifice, I had almost said an enchanted palace, affording her a commodious and dry retreat in the very midst of the water. Here she reposes unmoved by the storms that agitate the surface of the pool, and devours her prey at ease and in safety. Both sexes form these lodgings. At a particular season of the year the male quits his apartment, approaches that of the female, enters it, and enlarging it by the bubble of air that he carries with him, it becomes a common abode for the happy pair. The spider which forms these singular habitations is one of the largest European species, and in some countries is not uncommon in stagnant pools."

The water-spiders run about on aquatic plants and catch the insects which live among them. They lay their eggs in the nest, and the young come out and spin little nests of their own, as soon as they are big enough. The hairs, with which their bodies are covered, keep the skin from becoming wet as they go through the water; and in the nest, which is like a diving-bell, they are as dry as if it were under a stone, or in a hole on dry land.

The Rev. J. G. Wood states that the water-spider "is a tolerably common species in England, being especially fond of inhabiting quiet and rather deep ditches, when it is well sheltered, and the stream is not rapid enough to endanger the security of its domicile. It is necessary that the water-plants to which the nest is fixed should be sufficiently firm to prevent the nest from being swayed to one side, as, in that case, the air would escape, and the water make its entrance. Owing to the vast number of these spiders that have been sent to the London markets—where they are sold to those who possess fresh-water aquaria—the species is not now nearly so plentiful as used to be the case, and, indeed, it has been almost extirpated from several localities where it was formerly seen in great numbers."

10.—Trap-Door Spiders.

Comparatively little was known about these very curious spiders until the publication of Mr. Moggridge's very interesting work, in which he records with great minuteness the observations he made in the south of France.

The following illustration, Fig. 27, represents the principal kinds of nests that these spiders construct. The most northern genus of this family, *Atypus*, makes a strong silken tube, part of which forms the lining of a hole in the ground, and part lies above the surface, among stones and plants, Fig. 27, A. The mouth of the tube is almost always closed, at least when the spider is full-grown.

Another genus, which lives in warm countries, makes tubes lined with silk and closed at the top by a trap-door. A common species in California, *Cteniza Californica*, is brought thence by travellers. It digs its hole in a fine soil that becomes, when dry, nearly as hard as a brick; but the spider probably works when the ground is wet. The holes are sometimes nearly an inch in diameter, and vary in depth from two or three inches to a foot. The mouth is a little enlarged and closed by a thick cover that fits tightly into it, like a cork into a bottle. The cover is made of earth fastened together with threads, and is lined, like the tube, with silk, and fastened by a thick hinge of silk at one side, Fig. 27, B. When the cover is closed it looks exactly like the ground about it. The spider, when alarmed, holds on the inside of the door with its mandibles, and the two front pairs of feet; while the third and fourth pairs of legs are pressed out against the walls of the tube, and hold the spider down so firmly that it is impossible to raise the cover without tearing it.

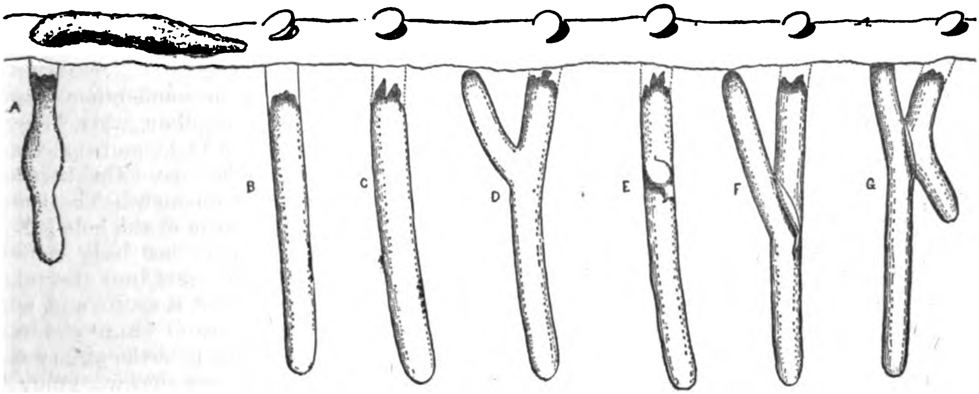


Fig. 27.

Trap-door nests: A, nest of Atypus; B, nest with thick door; C, nest with thin door; D, branched nest; E, nest with two doors; F, branched nest with two doors; G, nest with two branches.

One of the European species, described by Moggridge, makes a thin lid to its tube, and lets it rest on the top of the tube, Fig. 27, C, covering it with leaves, moss, or whatever happens to be near at hand, so that it is not easily distinguished.

A second species differs by constructing two or three inches down the tube another door, Fig. 27, E, hanging to one side of the tube when not in use; but, when one tries to dig the spider out from above, she pushes up the lower door, so that it looks as if it were the bottom of an empty tube.

Another species digs a branch obliquely upward from the middle of the tube, closed at the junction by a hanging-door, which, when pushed upward, can also be used to close the main tube, Fig. 27, F. What use the spider makes of such a complicated nest, nobody knows from observation; but Mr. Moggridge supposes that when an enemy, a parasitic fly, for instance, comes into the mouth of the tube, the spider stops up the passage by pressing up against the lower door; but, if this is not enough, it dodges into the branch, draws the door to behind it, and leaves the intruder to amuse himself in the empty tube. The branch is sometimes carried up to the surface, where it is closed only by a few threads; so that, in case of siege, the spider could escape, and leave the whole nest to the enemy.

In these nests the spiders live most of the time, coming out at night, and some species in the daytime, to catch insects, which they carry into the tube and eat. The eggs are laid in the tube, and the young are hatched and live there till they are able to go alone, when they go out and dig little holes for themselves. As the spider grows larger the hole is made wider, and the cover enlarged by adding a layer of earth and silk: so that another cover is made up of a number of layers, one over the other, on top of the original little cover.

Moggridge relates (page 118) how a *Nemesia Meridionalis* constructed a trap-door in captivity, after he had placed it on a flower-pot full of earth, in which he had made a cylindrical hole. "She quickly disappeared into this hole, and during the night following she made a thin web over the aperture, into which she wove any materials that came to hand. The trap-door at this stage resembled a rudely constructed, horizontal, geometrical web, attached by two or three threads to the earth at the mouth of the hole, while in this web were caught the bits of earth, roots, moss, leaves, etc., which the spider had thrown into it from above. After the second night the door appeared nearly of the normal texture and thickness, but in no case would it open completely, and it seemed that the spider was too much disgusted with her quarters to think it worth while to make a perfect door."

These spiders are accustomed to put on their door moss like that which grows around it, so as the more effectually to conceal it from observation. In one case where Moggridge had cut out a little clod of mossy earth about two inches thick and three square on the surface, containing the top of the tube and the moss-covered cork-like door of a *Nemesia*, he found on revisiting the place, six days later, that a new door had been made, and that the spider had mounted up to fetch moss from the undisturbed bank above, planting it in the earth which formed the crown of the door. Here the moss actually called the eye to the trap which lay in a little plain of brown earth made by his digging.

The food of the European trap-door spiders consists largely of ants and other wingless insects, and they have been known to eat earth-worms and caterpillars. Mr. Moggridge has often seen them, even in the daytime, open their doors a little, and snatch at passing insects, sometimes taking hold of one too large to draw into the tube. One time he and some friends marked some holes, and went and watched them in the night. The doors were slightly open, and some of the spiders' legs thrust out over the rim of the hole. He held a beetle near one of the spiders; and she reached the front part of her body out of the tube, pushing the door wide open, seized the beetle, and backed quickly into the tube again, the door closing by its own weight. Shortly after, she opened it again, and put the beetle out alive and unhurt, probably because it was too hard to eat. He next drove a sow-bug near another hole; and the spider came out and snatched it in the same way, and kept it. None of the spiders came entirely out of their holes, and they were only a little more active than in the daytime.

11.—GROWTH OF SPIDERS—THEIR EGGS AND COCOONS.

Persons unfamiliar with spiders find it hard to tell young from old, and male from female. This is caused, in part, by the great differences between different ages and sexes of the same spider, on account of which they are supposed to belong to distinct species.

The adult males and females are only distinguished from each other, and from the young, by the complete development of organs peculiar to each sex.

The males are usually smaller than the females, and have, in proportion to their size, smaller abdomens and longer legs. They are usually darker coloured, especially on the head and front part of the body; and markings which are distinct in the female run together and become darker in the male. In most species these differences are not great; but in some no one would ever suppose, without other evidence, that the males and females had any relationship to each other. The most extreme cases of this kind are *Argiope* and *Nephila*, where the male is about a tenth as large as the female.

The female of one of the common crab spiders is white as milk, with a crimson stripe on each side of the abdomen; while the male is a little brown-and-yellow spider, with dark markings of a pattern common in the family to which it belongs.

When the female is prepared to lay her eggs, she makes a little web and drops them upon it; then she covers them over with silk, forming a cocoon, in which the young remain till some time after they are hatched. The laying of the eggs is seldom seen, for the spider does it at night and in retired places, and often in captivity refuses to lay at all.

Many spiders make their cocoons against a flat surface, where they remain attached by one side. *Attus mystaceus* spins, before laying, a thick nest of white silk on the under side of a stone. In this she thickens a circular patch on the upper side, next the stone, and discharges her eggs upward against it. They adhere and are covered with white silk.

Epeira strix spins, before laying, a bunch of loose silk; she touches her spinnerets, draws them away a short distance, at the same time pressing upward with the hind feet; then she moves the abdomen a little sideways, and attaches the band of threads so as to form a loop. She keeps making these loops, turning round, at the same time, so as to form a

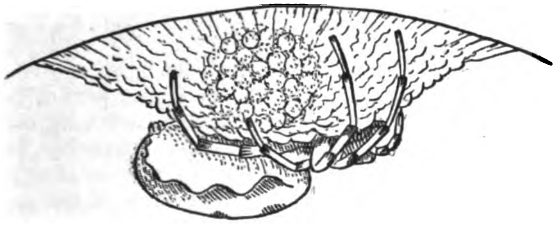


Fig. 28.

rounded bunch of them, into the middle of which she afterwards lays the eggs, as in Fig. 28. The eggs, which are like a drop of jelly, are held up by the loose threads till the spider has time to spin under them a covering of stronger silk. *Epeira vulgaris* makes a similar cocoon upward, downward, or sidewise, as may be most convenient.

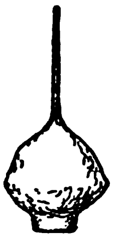


Fig. 29

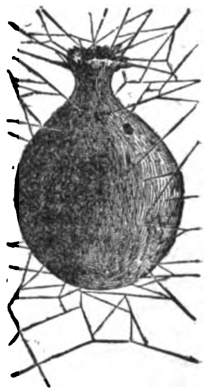


Fig. 30

Most of the *Theridiidæ* make cocoons of loose silk, held up in the webb by numerous threads. Some hang the cocoon by a stem, Fig. 29.

The large species of *Argiope* makes a big pear-shaped cocoon hanging in grass or bushes, Fig. 30. A stem of loose brown silk is first made, and under this the eggs attached (at any rate this had been done in onewhich had been abandoned unfinished); then a cup-shaped piece is made under the eggs; the bunch of loose silk is spun over all, and finally the paper-like shell.

These cocoons are made late in the summer and the young stay in them till the next season. Many cocoons of irregular shape may be found in cellars and other retired places during the winter; the eggs contained in them are hatched in the following spring.

The hatching occupies a day or two. First the shell, or rather the skin, cracks along the lines between the legs, and comes off in rags; then the creature slowly stretches itself and creeps out. It is now pale and soft, without any hairs or spines and only small claws on its feet; but in a few days it gets rid of another skin and begins to look like a spider. The eyes become darker coloured, marks on the thorax become more distinct, and a dark stripe appears across the edge of each segment of the abdomen; the hairs are long and few in number. Before the next month, the brood usually leaves the cocoon and for a time they live together in a web spun in common. As the spider grows large it has to moult from time to time; as many as nine moults have been observed in a species of *Tegenaria* that lives for several years.

Many species, and among them some of the largest, live only one year, hatching in the winter, leaving the cocoon in early summer and laying eggs and dying in autumn. Other species seem to require two years for their growth; hatching in summer, passing their first winter half grown, growing up the next summer, but laying no eggs till the second spring. Some species are found adult at all seasons, and may live several years. After spiders have passed their second moult, they usually live in the same places, and follow the same habits, as the adults.

Several house spiders have probably been imported, like rats, and are found all over the world; while other very common species never spread beyond the countries where they are most abundant.

THE PEA WEEVIL *(Bruchus Pisi).*

By W. Saunders, London.

The pea weevil, or pea bug as it is more commonly called, has become a very serious evil in Ontario, and prevails at present to such an extent as to entail enormous losses on the farming community, since peas are cultivated over a greater or lesser area on almost every farm. This insect, which is believed to be a native of America, was first noticed in Pennsylvania, attacking the pea early in the present century, and from thence has gradually spread over the whole of the Northern Uuited States and Canada; it has also been carried to Europe where it has firmly established itself in the southern portions, and in

England, although it is not nearly so abundant and destructive in Europe as it is with us.

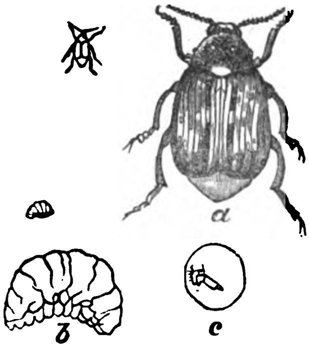


Fig. 31.

This beetle, Fig. 31, *a*, is a little more than one-tenth of an inch long, of a rusty, blackish colour with a whitish spot on the hinder part of the the thorax, and several of the same colour on each wing case behind the middle; also a white spot shaped somewhat like the letter T on the tip of the body. In the cut, the insect is much magnified; the small outline figure at the side shews the natural size.

As soon as peas are in bloom the pea weevils are on the wing, and when the young pods are formed the females deposit their eggs on the surface, fastening them with a glutinous fluid, secreted from their bodies. These eggs are very small, much longer than wide, pointed in front and blunt behind, and of a yellow colour. The young larva, which is hatched in a few days, is of a deep yellow colour with a black head. It eats its way at once through the tender pod, and directly into the first pea it meets with, the wounded portion closing up in the growing pod, and leaving but a mere speck in the pea to mark the place of entrance. The larva feeds on the growing pea and consumes its substance, usually avoiding any injury to the germ, so that infested peas will generally germinate as readily as those which are free from the bug. The soft, whitish fleshy grub, Fig. 31, *b*, when full grown, eats a circular hole on one side of the pea, not quite through to the surface, but leaves the thin skin unbroken. It then changes to a chrysalis, and finally to a beetle within the pea, and when the beetle is ready to escape it has only to eat its way through the thin skin which the larva had left covering the hole.

Few persons are aware how many insects they unconsciously devour while indulging in the luxury of early green peas. In this instance, as in many others, "Where ignorance is bliss, 'tis folly to be wise." Some console themselves with the idea that the fat little creatures having fed on nothing but green peas, are only green peas in a modified form, and besides this they are cooked. A very small discoloured spot on the pea indicates the presence of an occupant, and if the pea be opened at this point the whitish footless grub will be found within.

Sometimes, especially during an unusually warm season, many of the weevils will escape from the peas in the fall, but usually they remain in them during the greater part of the winter, and many do not issue until after the peas are sown as seed in the ground. Hence we see how easily this pest may be introduced into a district hitherto free from it, by sowing infested peas. All seed peas should be carefully examined, and as the insects diminish the weight of the peas in which they lodge nearly one half, an expeditious and moderately safe way of separating the sound from the unsound peas is to throw them into water when most of the good peas will sink while the infested ones will float

A very effectual remedy, and one which would be very successful were it generally adopted, is to keep seed peas in tight vessels in a dry place over one year before planting them, during which time, if any of them contain bugs, these will escape and perish without having opportunity to propagate.

It has also been recommended to scald the peas about to be sown by dipping them for a moment or two in hot water before planting, by which means the weevils are killed and the sprouting of the peas quickened.

As the duration of this insect in the beetle state is limited, peas sown late are much more likely to escape injury than those planted early. Harris, in his "Insects Injurious to Vegetation," mentions an instance of a gentleman who sowed his peas on the 10th of June for six years in succession, and never found an insect in them during that period.

A very effectual method of getting rid of this pest from any section of country would be for the farmers to mutually agree to sow no peas for one year. At a recent meeting of the County Council in London, Mr. Henry Anderson, of Westminster, presented a memorial to that body, setting forth the importance of this subject, and asking the Council to petition the Legislature to pass an Act giving County Councils the power to prohibit entirely the growing of peas in any one section for a season. Such a course faithfully carried out and followed by a careful selection of seed the next season, would doubtless almost, if not entirely, eradicate the pest from such district for a time, and thus effect a large saving to the community; hence it is most desirable in the interest of our farmers that some such permissive restrictive measure be enacted. Unfortunately, in this instance, either from want of proper information on the subject, or perhaps underrating its importance, the Council declined to take action in the matter.

SCARABÆIDÆ—DIGGERS.

By James Fletcher, Ottawa, Ont.

The members of the family of beetles, which bear the above name, have been objects of peculiar interest to mankind for thousands of years. This is chiefly owing to the fact that the typical species of the family to which it belongs, played such an important part in the religion of the ancient Egyptians, and also on account of those very habits which gave rise to the devotion and adoration lavished upon it by that remarkable people.

These beetles belong to a division of the insect world to which Latreille gave the name of *Lamellicornes* or leaf-horned, which corresponds with the Linnæan genera *Lucanus* and *Scarabæus*, and are easily distinguished by having the antennæ, which are generally short and nine or ten jointed, terminated by a large club-shaped organ, composed of, as a rule, three of the apical joints, which are formed into a series of flat plates, and open like the rays of a fan or the leaves of a book, or of which the basal joint of the club is hollowed so as to form a kind of cup receiving the subsequent joints; in others the terminal joints form a kind of comb. The form of these insects is robust and heavy, and the males are often to be known at first sight by the presence of singular horns on the head and thorax, and by the great size of the mandibles. So different an aspect is given to the males by these organs that, in some instances, it seems almost incredible that they can belong to the same species as the females, and it has frequently happened that the two sexes have been recorded as two different species.

This division is one of very great extent, and embraces within its wide, but clearly defined limits, insects of the most various characters. It comprises the largest and handsomest of the beetle race, and at the same time some individuals very small and sombre in appearance. Strangely enough, too, it includes within its ranks some of the most beneficial and some of the most destructive of all insects; hence, as well as from the immense number of species, and the consequently important *rôle* they must perform in the economy of nature, they were placed by Linnæus and Fabricius at the head of the *Coleoptera*, or sheath-winged insects (κολεος—a sheath, and πτερα—wings.) This arrangement, however, has not been adhered to by later authorities, and they are now placed immediately before the *Buprestidæ*.

The majority of these insects, and especially the gigantic species, to be mentioned later, are inhabitants of the tropics.

The two Linnæan genera, above named *Lucanus* and *Scarabæus*, constitute the two primary groups into which the *Lamellicornes* are divisible, and to which Dumeril gave the sectional names

Priocera (*Lucanus*), club of antennæ serrated.

Petalocera (*Scarabæus*), club of antennæ lamellated.

The first of these or the family Lucanidæ, *Leach*, corresponds to the Linnean genus *Lucanus*, and is distinguished by having the antennæ abruptly bent into an angle about the centre, generally composed of ten joints, and terminated by a pectinated, fissile, or sub-serrated club. A striking characteristic, too, of this family is the exserted and unusually developed mandibles of the males, which gives them a most ferocious aspect, and from which the popular names of stag-beetles, horn-bugs and flying-bulls have originated. These organs in some instances (*e.g.*, *Chiosognathus Grantii* of Chili), equal the entire length of the body. They are capable of biting with great force, and the females, notwithstanding that they are furnished with very small mandibles in comparison to their larger mates, are considerably the more formidable of the two, their short, thick, sharp-pointed mandibles, being provided for the purpose of boring holes in bark to deposit their eggs, are very strong.

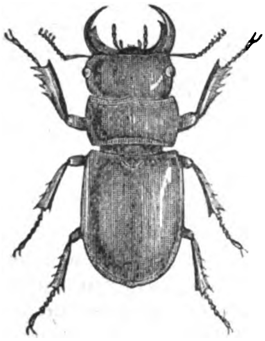


Fig. 32.

This family is represented in Ontario by a small number of insects, the most typical of which is *Lucanus dama*, Thunb. (Fig. 32), which is a large, smooth, brown beetle, of little more than an inch in length. The jaws of the male are very long, and finely pointed and are curved like a sickle and bear on their inner edge, near the middle, a small sharp tooth. The head, to bear these large mandibles, is necessarily large; in the female it is much smaller and narrower, and is densely covered with punctures which give it a rough appearance. The eggs, which are yellow and oval, are laid in a hole, made by the female, in the bark of a tree, near the root, about the end of July, when this beetle should be sought for. The grubs live in the trunks and roots of several sorts of trees, but chiefly in old apple trees, willows and oaks; they are long, thick, nearly cylindric white grubs, of a very fleshy consistency, closely resembling, in general appearance, the larvæ of the *Scarabæidæ*, but they are distinctly separated by certain characteristic points in their internal structure, and by their bodies being destitute of the transverse foldings so conspicuous in the latter. The larvæ of the Lamellicornes are remarkable for having their bodies curved, so that the end of the abdomen is drawn under the body, which prevents them from crawling on a flat surface and necessitates their always lying on their sides. The larva of *Lucanus dama* has a horny rust-coloured head furnished with two powerful jaws, which it employs in gnawing the wood, upon which it feeds and which it reduces to a kind of tan. The antennæ are short. It has six reddish articulated legs, which are attached to the first three segments of the body. When mature it forms a cocoon out of the minute chips and debris which it has itself made during its life. In this cocoon it undergoes its transformation to the pupa and perfect insect. In the pupa state the large mandibles or horns of the male are folded down over the breast. Rösel, who studied thoroughly the European representative of this family (*Lucanus cervus*) and discovered that the male and female were one species and not two, as previously believed, says that that insect lives six years as a larva. The injury which they cause is sometimes considerable, as they bore not only into the solid wood but also into the roots of trees.

It is supposed that the larvæ of these insects are what were eaten by the Romans, as a great delicacy, under the name of Cossus.

The name of *Pectinicornes* or "comb-horned," has been proposed for this family, but so far it has not been generally accepted by entomologists.

The *Petalocera* of Dumeril (*Scarabæus* of Linnæus) or second division of Lamellicorn insects, is one of immense extent, being divided into more than 700 genera, comprising some 6000 species. They are distinguished from the foregoing family by having the antennæ not abruptly bent into an angle, eight, nine or ten jointed and terminated by a large mass, composed of several, generally three, plates, which shut and open at will. In some species these plates are flat, so as to be placed side by side, in others the basal one is hollowed so as to form a sort of box in which the intermediate plate is enclosed. The mandibles do not exhibit any striking sexual variations; but the head and thorax of the males in some of the groups, are armed with horns and protuberances of the most bizarre and diversified appearance, of which it is very difficult to conceive the uses. The antennæ of the males too, are occasionally developed more than those of the females. The mentum is large and horny. The body is generally more or less convex, the legs robust and as a rule toothed on the outer edge.

These insects are almost all of them vegetable feeders, the greater part subsisting upon it when in a state of decay. Some in the perfect state feed upon leaves and flowers, and their *larvæ* upon the roots of grass, etc., often causing great damage. In the colours of these insects we find a conformity to their habits; those that burrow under ground are generally of black and obscure hues, while those that frequent leaves and flowers are often splendidly attired. The origin of the name Scarabæus is doubtful; the word never occurs but in the writings of Latin authors; yet Fabricius and Olivier give its derivation from the Greek σκάπτω—to dig, which MacLeay doubts, considering it to be of Etruscan origin, adding that it may have been obtained from the Greek σκαριφαομαι—the verb διασκαριφῆσαι being properly applied to the actions of animals which scratch or dig up the earth with the claws. Pliny gave a description of the sacred beetle of the Egyptians under the name *Scarabæus*; and in later times Linnæus applied it in a general way to the whole of the Lamellicorn beetles, placing the gigantic horned species, at the head of the genus. The Rev. J. G. Wood writes as follows:—"The Latin word Scarabæus is nothing but a corruption of the Greek word καραβος—a crab. It was also employed to designate the cuttle-fish, on account of its mode of crawling, the name being composed of two Greek words, signifying 'to walk on the head.'" By Aristotle, it is applied to an insect which is evidently the stag-beetle; but Linnæus was the first who gave it to the ground-beetle, and it has been so universally employed that it will continue to hold its place.

It is possible that the name may have been applied to these beetles by Pliny, from the fact that the female of the sacred Scarabæus, when it is rolling the balls of dung, in each of which it has deposited an egg, to the place where it has dug its burrow, does so, by walking backwards and pushing the ball before it. Now from the size of the ball, generally over an inch-and-a-half in diameter, it actually has almost to stand on its head when it places its feet on the top to roll it.

It would be impossible to do more, here, than mention briefly some of the most interesting sub-families and species of this extensive family of insects, the members of which exhibit such great variations in the form and arrangement of the various organs of the body, although preserving a characteristic appearance, and conjoined with it the lamellate antennal club and fossorial legs.

They have been conveniently divided into three divisions by De Geer.

1. Those which live upon or beneath the surface of the earth, or "ground beetles."
2. Those which in the perfect state are found upon and devour the leaves of trees, or "tree-beetles."
3. Those which in the perfect state frequent flowers, or "flower-beetles."

To the first group belong the most useful of insects, who in providing for the perpetuation of their species, at the same time till and manure the soil and dispose of offensive matter. This will be better understood by a glance at their life histories.

In Ontario we sometimes meet with a fine ground beetle, named *Canthon lævis*, Drury, which belongs to the same sub-tribe (*Ateuchini*) as the Egyptian Scarabæus, to which it bears great resemblance. A noticeable feature of these insects is the length of their hind-legs, and the proximity of the bases or coxæ to the end of the body. This peculiar structure is of particular service to them. Their mode of depositing eggs is very remarkable. The female having discovered a deposit of fresh cow-dung, at once seeks for a suitable place, and digs out a pit about 18 inches deep; she then returns and gathers together exactly so much of the material as will amply supply one grub with food, and in the centre of this she deposits an egg. She then proceeds to form it into a round ball; at first it is quite wet and soft, but by turning her back to it she works it backwards, in the hot sun-shine, by means of her long hind-legs, over dusty or sandy soil, and it gradually becomes rounder and harder, by taking up some of the dry dust as it goes along. When she arrives at the hole, she previously prepared, if her ball is dry and hard enough, she drops it in and covers it up; but if it is not sufficiently hard, she takes it for another short circuit, during which it picks up more dry dust and gains the required consistency, and then brings it back to the hole and buries it. If the day is wet or even cloudy, these insects will not work at all. Occasionally intervening objects render this task of transportation exceedingly difficult; but she works away with the utmost patience and determination, and is generally successful; sometimes as a last resource when obstacles of unusual magnitude have to be surmounted, she will call in the aid of one or two other beetles. It is curious, too, how cheerfully they seem to work for each other, and although it is almost impossible to induce one of these insects to abandon the ball which contains her egg, yet if when two females are engaged in depositing eggs at the same time, the balls are changed, neither seems to be aware of the deception, and they labour as contentedly for each other's egg as if it were their own.

There are also several species of another sub-tribe (*Coprini*), closely allied to the *Ateuchini*, which possess somewhat similar habits. They differ chiefly by frequently having the heads of the males armed with a large curved horn, and by having the middle and hind tibiæ gradually thickened, which unfits them for transporting the balls of material which serve for the food of the larvæ; though some of the species do construct balls, they bury them in the place where they are formed. Notwithstanding that these insects live in such unclean localities, they are remarkable for their constant state of glossy cleanliness; this is due to an oily fluid which they secrete, and which prevents all the nasty things they live amongst from collecting upon them or staining their coats.

The type of this group (Scarabæidæ), is the renowned *Ateuchus Sacer*, or Sacred Scarabæus, of the Egyptians, perhaps the most celebrated of insects. It was worshipped by them as a god, and dried specimens of the actual beetles or models of all sizes and in every possible material, from the commonest stone to the most precious metals, have been frequently discovered in Sarcophagi, or rolled up in mummies and other ancient relics found among the monuments on the borders of the Nile. For common use they were made very small, and some were pierced so as to form necklaces for the women, others were used as seals, as is shewn by the inscriptions beneath them. Plutarch states that the military caste made use of the figure of a Scarabæus as a seal, and Horappollon explains this by asserting that this insect peculiarly represents man, since (as was formerly believed) "there are no females of its species." A male wishing to procreate, said the Egyptians, takes some of the dung of an ox, and having fashioned it into the shape of the world, rolls it with its hind legs from east to west, and places it in the ground, where it remains twenty-eight days. On the twenty-ninth day the ball is exhumed and thrown into the water, where it opens and another male comes forth. Some of the models of the Scarabæus which have been found are of very large dimensions—one in the British Museum, carved in granite, is about four feet in length. There are several smaller specimens cut from marble, porphyry, agate, lapis-lazuli, garnet and gold.

Representations of it are to be found everywhere throughout the whole land of Egypt, carved upon the temples, tombs, monuments and obelisks.

The reverence shewn to these insects seems to have been called forth by many causes in their imaginative minds. Being an agricultural people, and knowing the habits of the Scarabæus, they worshipped it, because they could appreciate how, by the manner in which it provided for the welfare of its own offspring, it also benefited them by fertilizing the ground, and removing from the surface obnoxious matter. Its sudden appearance in great numbers on the sandy margins of the Nile, after the fall of the water every year, together with its extraordinary motions whilst rolling along its globular balls of dung, were regarded as mystically representing the resurrection of the soul, and the motions of the earth and sun. It, with the earthen ball containing an egg in the centre, was also regarded as an emblem of fecundity, and to this day, the beetle is eaten by the women of Egypt. On account of the shape of the egg-ball, and the wonderful care bestowed upon it by the parent beetle, it was employed as an emblem of the Creator's watchful care over the world.

In addition to these, a short mention must be made of two other families of ground beetles which are much commoner, and which from that account perform the useful work of their kind much more fully than the above-named interesting species. These two families are the *Geotrupidæ* or earthdiggers, and the *Aphodiidæ*, or cow-dung frequenters. They do not form balls of the food for their larvæ, but burrow straight through the mass and down into the earth below; they then bring down some of the material from above, and deposit an egg in it, in the same way as the others. Two well known instances of these families are *Geotrupes blackburnii*, a small, blackish beetle with a green lustre, of about one-half or three-quarters of an inch in length, and *Aphodius fimetarius*, a small cylindric-shaped insect, with coral-red elytra, which is always to be seen about manure heaps in spring, and although it is one of the commonest of our insects, was only introduced from Europe a comparatively small number of years ago.

To the second division of the Scarabæidæ, namely, the "Tree-beetles," belong a large number of insects, whicn are perhaps even more injurious than their near relatives, the ground beetles, are beneficial. These are of much greater interest to the farmer than any other class, and as several of them are of large size and very common, they annually destroy an enormous amount of produce. The greatest amount of injury is done during the larval state, which they spend in the ground consuming the fibrous roots of plants. The most injurious of these beetles, on account of the great amount of damage they have done, have already called forth very full descriptions in our annual reports, consequently, it is not worth while again to take up space by describing them. Among the most prominent are:

The May-bugs or Chafers, which were all included by Fabricius in the genus *Melolontha*, a word used by the ancient Greeks to distinguish the same kind of insects, which were supposed by them, as the name implies, to be produced from or with the flowers of apple trees. They are, I have no hesitation in saying, the most injurious insects in the world. The accompanying figure (33) gives a faithful representation of these insects in their different stages, and they may be easily recognized from it; they are already too well known, I fear, to farmers. In fig. 33, No. 2 the larval stage, known as the "White Worm," which is the greatest depredator, is also represented. It is a soft white worm with six legs and a brownish head; the body is very fat, and is about an inch and a half long. It lives for several (as a rule three) years in this stage, during which time it destroys everything that comes within its reach in the way of roots of plants. It has been found to be very injurious to the roots of strawberries, potatoes, corn and other vegetables, but particularly so to grass. They have been known to abound in such prodigious numbers that they ate all the roots of the grass in a pasture, and the plants could be rolled up from the surface as if they had been cut off by a turf-cutter's spade. The pupa stage of this insect is also shewn. The insect itself is scientifically known by the name of *Lachnosterna quercina*, Knoch. A full and most interesting account of this insect is to be found in the Annual Report of 1872, and in the same report also will be found an article by Mr. Saunders treating of the "Rose-bug," *Macrodactylus subspinosus* Fab. (fig. 34), an insect also belonging to this division, which has proved very destructive to grape vines in some localities.

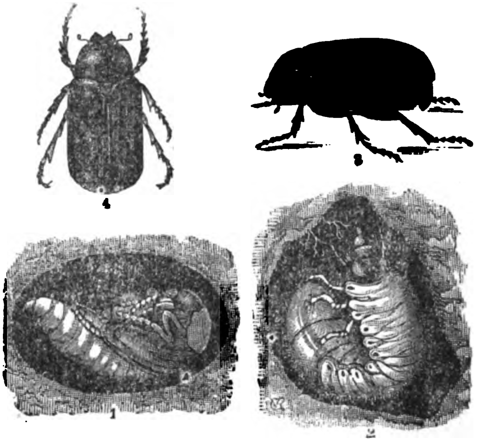
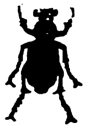


Fig. 33


Fig, 34

There is another beetle which feeds entirely on the wild and cultivated vines, but never occurs, I believe, in sufficient numbers to cause very material damage; this is the spotted vine beetle or *Pelidnota punctata*, Linn. It is a large handsome beetle, of which Fig. 35 is a life-sized representation, the colour of the smooth elytra or wing cases is reddish-brown and each of them is decorated with three conspicuous black spots. The thorax, which is of a deeper colour, also bears two more rather smaller ones. The jaws and scutellum are both black and its legs and under surface are of a dark metallic green. The Larva, Fig. 35, *a*, is a large fat grub much like the white-worm but may be at once identified by a distinct heart-shaped swelling, Fig. *d*; on the last segment; the colour too, is of a purer white, and the skin is less wrinkled. It has been found feeding upon the rotten stumps and roots of pear trees. Towards the end of the summer the larva forms a cocoon of chips

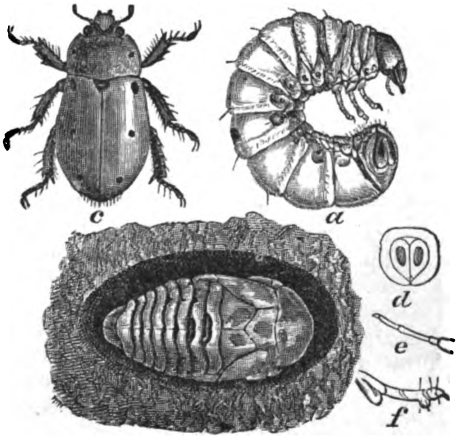


Fig. 35

of wood and about a fortnight after, the perfect insect emerges, and may be found on grape vines in Western Canada, during the months of July, August and September. To this division belongs the beautiful Goldsmith Beetle, *Cotalpa Lanigera*, of which an interesting account appeared in the February number of the *Entomologist*, written by Mr. Saunders. As many of the readers of the Annual Report do not read that periodical I insert it.

"This is, without doubt, the most beautiful of our leaf-eating beetles. It is nearly an inch in length (fig. 36), of a broad oval form with the wing cases of a rich yellow colour, with a pale metallic lustre, while the top of the head and thorax gleams like burnished gold of a brilliant reddish cast. The under surface has a polished coppery hue and is thickly covered with whitish wool; this latter characteristic having suggested its specific name *lanigera* (wool-bearer).

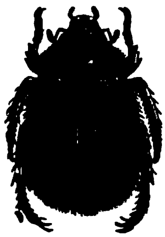


Fig. 36.

"This insect appears late in May, and during the month of June. It is distributed over a very wide area, embracing most of the northern United States and Canada, and although seldom very abundant, it is rarely that a season passes without more or less of them being seen. During the day, they are inactive, and may be found clinging to the under side of the leaves of trees, often drawing together two or three leaves—which they hold with their sharp claws—for the purpose of concealing themselves. At dusk they issue from their hiding places and fly about with a buzzing sound among the branches of trees, the tender leaves of which they devour; the pear tree, the oak, poplar, hickory, silver abele and sweet gum all suffer more or less from their attacks. Like the May bug, this beautiful creature is often attracted by light, and flies into open windows on summer evenings, dashing in a bewildered sort of way against everything it meets with to the great alarm of nervous inmates. In some seasons they occur in considerable abundance, and may be readily captured by shaking the trees on which they are lodged in the day-time, when they do not attempt to fly, but fall at once to the ground.

"The beetle is short-lived. The female deposits her eggs in the ground during the latter part of June, and having thus provided for the continuance of her species, dies. The eggs are laid during the night singly and at different depths, the number probably not exceeding twenty in all. They are very large for the size of the beetle, being nearly one-tenth of an inch in length, of a long ovoid form and white tranluscent appearance.

"In less than a month the young larva is hatched; it is of a dull white colour, with a brown polished horny head, and the extremity of the abdomen lead colour. The mature larva is a thick, whitish, fleshy grub, very similar in appearance to that of the common May bug, familiarly known as 'the white grub.' It lives in the ground and feeds on the roots of plants, and on this account it is sometimes very destructive to strawberry patches.

"Several years are required to bring this grub to maturity; finally it reaches its full growth in the fall, and changes to the perfect beetle early the following spring." I have never met with this insect nor the spotted vine beetle in this part of Ontario.

The last division, of "Flower Beetles," is very poorly represented in Canada, and the individuals rather small. They are, however, striking in appearance. They belong chiefly to the genus *Cetonia* and its allies, and are easily distinguished from the other scarabæians by their lower jaws, which are generally soft on the inside and are provided with a flat brush of hairs with which they collect the pollen and juices upon which they feed. Most of the brightly coloured kinds are diurnal, the dull ones nocturnal. Of the Canadian diurnal flower beetles, the Euryomias are perhaps the most typical. This genus was separated from the Cetonias by Lacordaire on account of the structure of the oral organs. We have two in our fauna; *E. inda*, Linn (Fig. 37), a rare insect in this part of Canada; but common enough in the West and in the United States to occasionally do much damage to the peach crop, by boring into the fruit just when it is ready for the market. The other species, *E. fulgida*, Fab., is also common in Western Canada; I have taken it in numbers near London, Ont., on the flowers of *Viburnum pubescens*, Pursh, in the month of June.

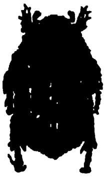


Fig. 37.

Of the nocturnal flower-beetles the two Osmodermas may be mentioned. These are large insects, remarkable for giving out an odour like that of Russian leather. They conceal themselves during the day in crevices of bark and hollow trees, where they feed upon the sap that flows from the bark. The name is derived from two Greek words—'οσμή, an odour, and δέρμα, the skin. *O. scabra*, Beauv., or the rough Osmoderma is rather the smaller of the two, and is about three-quarters of an inch long, with wide roughly-granulated elytra, and a considerably narrower thorax. When resting with their legs extended and almost straight, they have a very stilted, unlife-like appearance. The colour is deep purplish-brown, with a bronze lustre. The larvæ, which resemble those of the May-bug, may be found in the decayed portions of living apple and cherry trees, where they considerably quicken the work of destruction already begun. *O. eremicola*, Knoch, or the Hermit Osmoderma, is slightly larger and of a deep mahogany brown colour, perfectly smooth and highly polished. The male may be known by the presence of a deep pit in the middle of the thorax. In other respects it is like the last.

There is a very remarkable group of *Cetonidæ*, known by the name of Goliath beetles, to which Linnæus gave the name *Goliathus*, and placed them first in the whole of his arrangement of coleoptera. As the name implies, they are of very large size, some reaching the gigantic proportions of over four inches in length. What adds to their size, too, is that they are correspondingly broad.

A most interesting account of these beetles is to be found in the Rev. J. G. Wood's charming book, "Insects Abroad." He describes *Goliathus Druryii*, one of the largest and most beautiful, as follows:—

"Its length is four inches and a quarter, and the breadth exactly two inches. The head, which is furnished with two curious projections, is greyish-white, except the horns, which are black and deeply-punctured; the thorax is black, and upon it are drawn a number of creamy-white stripes; the elytra are warm chocolate with a velvet-like surface, surrounded with a belt of the same creamy-white as that upon the thorax—below, it is black with a mixture of green; the tibiæ of the first pair of legs are much flattened and deeply punctured; they are of a reddish hue. Those of the hind pair are furnished on the inner side with a dense ridge of golden hairs with a silken gloss; the tarsi are black. For many years this was the rarest of insects, only one specimen was known, which was picked up dead, floating in an African river. Of late years, however, several have been brought to England from the west coast of Africa, and among others a magnificent specimen of a cocoon containing the perfect insect. This is now in the British Museum, and is about the size of a swan's egg. It has very thin walls, but is strengthened round the middle exteriorly by a remarkable raised belt.

NOTES ON VARIOUS INSECTS.

By Wm. Saunders, London.

In the following remarks, reference will be made to some insects which, on account of their frequent appearance, or their curious or beautiful structure, are objects of interest to every observer of nature, and also to insects to which the writer's attention has been specially called during the past year.

Dytiscus Harrisii (fig. 38). This is one of the carnivorous water beetles, known as "Diving Beetles" or "Water Tigers," a strong, sturdy creature of an oval flattened form, with oar-like swimming legs, covered with long hairs. It is very active in the water, darting and diving about in different directions with great rapidity, the form of its body with sharp sides enabling it to cut through the water with great ease. They may well be called the sharks of the insect world, for there are few things that live in the water which are safe from their attacks. They are especial enemies of the larvæ of other aquatic insects; they feed also upon tadpoles, molluscs and small fish, and when pressed by hunger they do not hesitate to devour one another. They may be kept in an aquarium and fed on water insects and small pieces of raw meat, which they suck greedily.

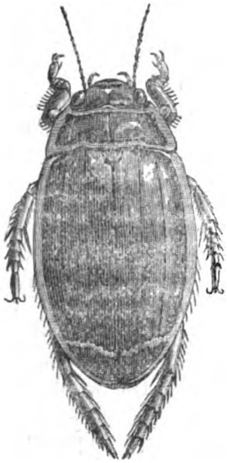


Fig. 38.

Fig. 38 represents this species very correctly; it is black with a broad margin of pale yellow on each side, and stripes of the same colour across the front of the head and on both the front and hind margins of the thorax; there is also an irregular yellow line crossing the wing covers near the tip. The under side is somewhat paler with reddish markings. Examples of this insect are often brought to us during the summer by persons who have found them in tubs or barrels of water and who were puzzled to know how they could get there. Beneath their hard wing covers they have a large pair of membranous wings, by the use of which they can fly with great ease; by this means they are enabled to travel from pond to pond in search of their prey. When wishing to change their location they crawl out of the water (usually towards evening) either up some reed or other water plant, or to the margin of the pond, and suddenly open their wing covers, expand their wings and rise into the air almost perpendicularly to a great height. Their descent is nearly as sudden and direct, and they often, when descending, drop into the water with considerable force. It would appear that they are enabled to distinguish the water from a considerable height by its glassy surface, for sometimes they have been known to drop with violence upon glazed garden sash, which they had evidently mistaken for water.

The female lays her eggs in the water, where they soon hatch into young larvæ, possessing the ferocious disposition and voracious appetite of their parents. The larvæ grow rapidly, and when mature are about two inches long, with large flattened heads armed with sickle-like jaws, with which they seize other insects and hold them while they suck their juices; they sometimes quickly snip off the tails of young tadpoles, and are known to attack young fishes and suck their blood. Many years ago, when searching with a dip-net in a pond for the larvæ of Dragon-flies, we caught one of these savage creatures, and supposing it could be as safely handled as the libellulæ larvæ, took hold of it, when it quickly turned and buried its sharp jaws in the flesh of one of our fingers, making the blood flow quite freely. These larvæ breathe through their tails, which they protrude into the air for that purpose, When full grown and about to assume the pupa state, the larva leaves the water, and burying itself in the earth, constructs there a round cell within which it undergoes its change, and if this occurs in summer, it appears in two or three weeks as a perfect beetle; but if in autumn it remains in the chrysalis state all winter, transforming to a beetle in the spring.

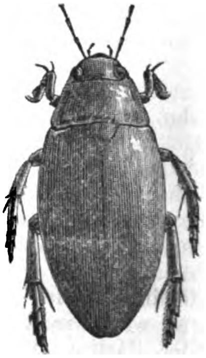


Fig. 39.

Fig. 39 represents another of our large water beetles, *Hydrophilus triangularis*. This species is entirely black, and so strong and muscular as to be difficult to hold in the hand when captured. The relationship of this tribe of insects (*Hydrophilus*) with the preceding one (*Dytiscus*) is very close. There is much similarity of form and a close resemblance in habits; their method of swimming, however, is different, for while in *Dytiscus* both paddles are moved simultaneously, in *Hydrophilus* they are moved alternately, hence the stroke of the latter is much less effective. We are not aware that anything has been written on the early stages of *Hydrophilus triangularis*, but in Europe the life history of a closely allied species, *Hydrophilus piceus*, has been carefully traced by several observers, and there is little doubt but that our species has similar, if not identical habits. The female of *H. piceus* has the singular habit of spinning a silky cocoon for her eggs, one side of which is furnished with an upright, bent, horny point, an inch long, which is supposed to be serviceable in conveying air to the interior. These eggs, some fifty or sixty in number, are placed in an upright position and in regular order in their receptacle, which is round and flattened and attached to some water plant at the surface of the water. In warm weather the larvæ are hatched in from twelve to fifteen days, when they escape at the lower part of the cocoon, which is closed only by a few threads. They undergo three moultings, and when full grown measure nearly three inches in length. The head is horny and of a very singular form, its lower surface being convex, while its upper surface is flattened. Its sharp and formidable jaws are well adapted for seizing and securing its prey. They are said to attain their full growth in July, when they leave the water, bury themselves in the earth, where they undergo their changes in a manner similar to that of *Dytiscus.*

THE TIGER SWALLOWTAIL (*Papilio turnus.*)

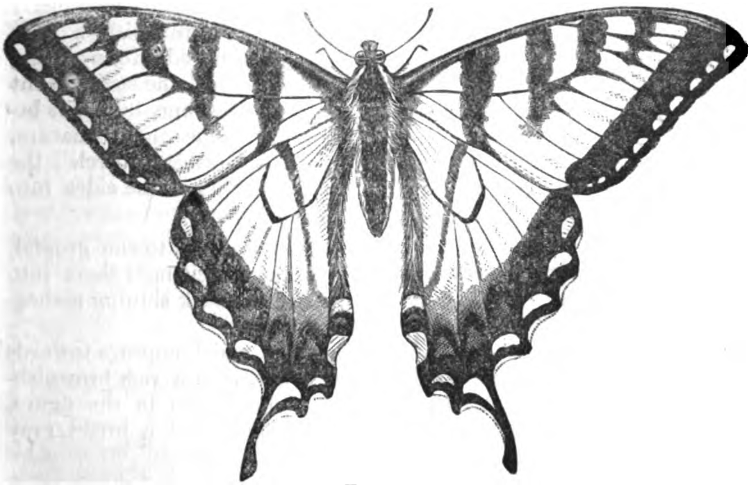


Fig. 40

This beautiful insect has been more than usually common in some districts of our Province during the past year, and always attracts attention from its size and its majestic flight, floating through the air as it does in the most stately manner. The butterfly, Fig. 40, measures about four inches across, when its wings are expanded; the body is black above, margined with pale yellow, the wings yellow banded with black, the hind pair powdered on their outer margin with patches of blue scales.

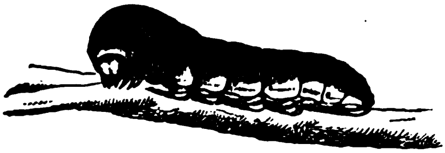
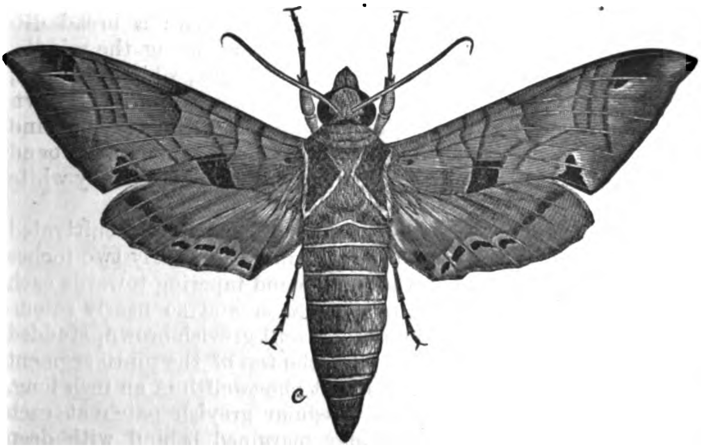


Fig. 41.

The caterpillar (Fig. 41) is rather a strange looking creature, of an olive green colour, with a whitish bloom and a prominent eye-like spot on each side of the fourth segment. It feeds chiefly on the apple, cherry, thorn and basswood. For a more detailed description of this insect we refer our readers to the report of our Society for 1873.

THE ACHEMON SPHINX (*Philampelus achemon*).



[Fig. 42.

In our report for 1872 we published a description of this insect which is a very beautiful and attractive creature in the perfect or moth state (Fig. 42), and a very odd looking object as seen in the larval condition. Quite recently Dr. John H. Garnier, of Lucknow, Ont., has written us in reference to this insect, which he has found injuring his grape vines. He found several of the larvæ feeding on a Rebecca vine, for which they seem to have a marked preference. He fed them in confinement and put in leaves of Rebecca, Delaware, Massasoit, Concord, Creveling, Salem and Martha, but they would eat only Rebecca leaves.

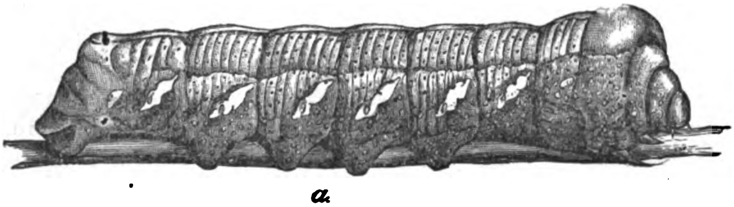


Fig. 43.

The caterpillar (Fig. 43) varies much in colour. When young it is usually green with a long curved horn rising from the last segment but one, but as it becomes more mature, in moulting the horn disappears, and its place is occupied by a dark polished tubercle; the colour also changes frequently to a pale straw or reddish brown, shading at the sides into a rich brown. It has six irregular cream-coloured spots along each side.

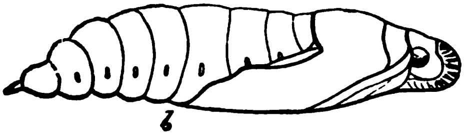


Fig. 44.

When full grown it descends to the ground, and burrowing underneath, changes there into a chrysalis, Fig. 44, of a dark shining mahogany brown colour.

The moth (Fig. 42), which appears towards the latter end of June, is of a rich brownish-grey colour, variegated with light brown, and with the dark spots, shewn in the figure, deep brown. The hind wings are pink, with a band of dark spots and a broad grey border behind.

CATOCALA ULTRONIA.

In the genus Catocala is included a number of very beautiful moths, many of them of large size, and restricted in their distribution to the northern portions of America. Most of them have the hind wings red, banded with black, and hence have received the common appellation of "Red under-wings." Some few species, however, have the red ground replaced by white, or by plain black, or dark brown edged with white, but these latter are greatly in the minority and much less frequently met with than those with red hind wings. The fore wings are usually of varying shades of rich gray or brown.

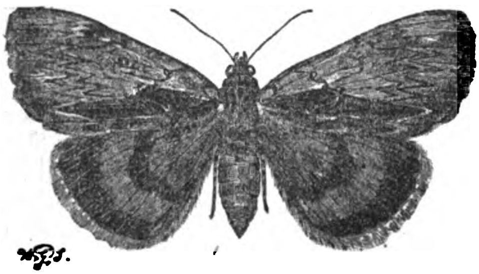


Fig. 45.

In *Catocala ultronia* (Fig. 45) the fore wings are of a rich umber colour, darkest along the hind margin, with a broad diffused ash-coloured band along the middle, not extending to the apex, which is brown; there are also several zigzag lines of brown and white crossing these wings. The hind wings are deep red with a wide black band along the outer margin and a narrower band of the same colour across the middle. The ciliæ which border the wings are partly white and partly brown.

The larva feeds on the leaves of wild plum and is also found attacking the cultivated varieties. When full grown, which is about the 20th of June, it is nearly two inches long, a leech-like creature with its body thickest in the middle and tapering towards each end. When at rest it adheres so closely to the bark of the branch and so nearly resembles it in colour, that it is difficult to detect. The body is of a dull greyish-brown, studded with brownish dots and rows of dull reddish tubercles. On the top of the ninth segment or ring there is a stout fleshy horn, nearly upright, about one-twelfth of an inch long, pointed and similar in colour to the body, but with an irregular greyish patch at each side. On the twelfth segment there is a low fleshy ridge margined behind with deep reddish brown and an oblique stripe of the same colour extends forward nearly to the spiracle on this segment. The terminal segment is flattened and has a number of small pale reddish and blackish tubercles scattered over its surface. Along the sides of the body close to the under surface there is a thick fringe of short fleshy-looking hairs of a delicate pink colour.

The under surface is also of a delicate pink, of a deeper shade along the middle, becoming bluish towards the margins with a central row of nearly round black spots which are largest from the seventh to the eleventh segments inclusive. The anterior segments are greenish-white tinted with rosy pink along the middle, with a dull reddish spot at the base behind each pair of feet.

When about to change to a chrysalis the larva makes a rough enclosure by drawing together fragments of leaves and fastening them with silken threads, within which it undergoes its transformation and appears as a moth in about three weeks afterwards.

The moth is on the wing during the greater part of July and August, is attracted by light and comes freely to sugar. All the insects of this family are night-flyers and expose their brilliant hind wings only in flight. When at rest the grey or dull brown upper wings overlap and cover up the gaily-tinted under wings like a very flat roof.

THE IO MOTH.—(*Saturnia io.*)

The caterpillar of this moth is very pretty and is well represented in Fig. 46. It is of a very delicate pea-green colour, with a broad white stripe on each side, bordered with lilac below. The body is covered with spreading clusters of green bristles tipped with black, and when the larva is handled these bristles sting like nettles. Judging from the number of communications we have had concerning this insect during the past year it must have been very common in many quarters.

While quite young these caterpillars feed in flocks, and have then the curious habit when moving from place to place of marching in regular procession like files of soldiers; when full grown, they lose this habit and feed singly. They are very general feeders and will eat corn, willow, hazel, sassafras, wild cherry, elm, and a number of other trees and plants. When full grown the larva crawls to the ground, where, among loose leaves and rubbish, it forms a rough outer covering, and within this a slight cocoon of tough brown silk.

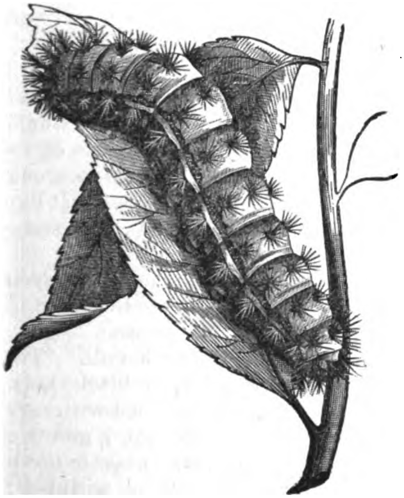


Fig. 46.

The moths are very handsome, and are remarkable for the difference between the sexes both in size and colour. The male (Fig. 47) is the smallest, and of a deep yellow colour, with darker reddish lines and spots. The hind wings are broadly shaded with purple next to the body; near the hinder margin is a curved purplish band, and within this again is a smaller one of a dark purple or violet colour. In the centre of this last band, and in the middle of the wing is a large round blue spot with a whitish centre and a broad, border almost black. The body is a deep yellow, a little darker on the thorax; the antennæ are broadly toothed.

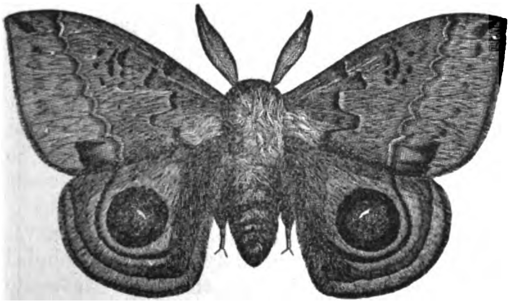


Fig. 47.

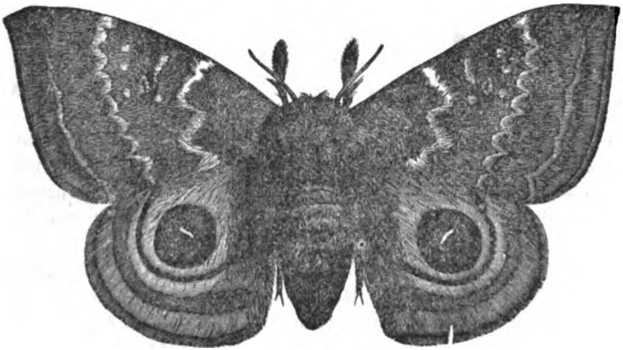


Fig. 48.

The female (Fig. 48) is larger than the male, and varies much in colour, from a deep purplish brown to an ochreous red. The fore wings are covered by similar wavy lines; the inner margin is of a darker colour; the hind wings are marked very similarly to those of the male. These moths fly only at night.

THE AMERICAN CURRANT BORER (*Psenocerus supernotatus*).

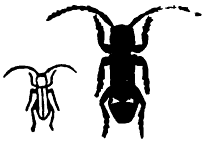


Fig. 49.

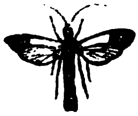


Fig. 50.

The accompanying cut (Fig. 49) represents an enlarged view of a native currant borer, *Psenocerus supernotatus;* the small outline figure shews the natural size. It is a beetle belonging to the family of longicorns, *Cerambycidæ*, which doubtless had its home originally among the wild currant bushes of our woods, but a more extended and inviting field having been opened for it by the planting of the cultivated varieties in our gardens, it has taken kindly to them, and although not so destructive as the imported currant borer, *Egeria tipuliformis* (Fig. 50), has in many instances, proved quite troublesome. In nearly all our gardens numbers of the currant stalks annually perish, and were it not for the vigorous growth of new shoots from year to year, the bushes would soon be destroyed. If one of these stalks is split asunder, the cause of its death is manifest, for through its whole length it is found to be more or less eaten away, the hollows being filled in places by a fine sawdust-like powder. This is sometimes the work of the imported currant borer (Fig. 50), and sometimes the work of the native species (Fig. 49).

Early in June the parent beetle of the native currant borer deposits her eggs upon the currant stalks, where they soon hatch into tiny grubs, which burrow into the heart of the stem, and feeding on its pith, reach full growth before the close of the season. They are footless grubs, which measure, when full-grown about half an inch in length. The head is scarcely half as broad as the body, is of a dark brown colour, with black jaws. The body is whitish with some brown dots along each side, and is slightly clothed with very fine short hairs. When full-grown, and about to change to a chrysalis, the larva gnaws a channel through the woody fibre to the outer bark, so that when changed to a beetle it can make its escape by merely rupturing the bark. The cavity thus made is filled with little chips to prevent the bark from being prematurely broken, and below this stuffing the insect constructs a bed of short, woody fibres, packing the passage below with a finer material resembling sawdust. Within this enclosure, which is about half an inch in length, the larva changes to a chrysalis, and reposes until the fully formed beetle is ready to emerge; then gradually drawing away the obstacles to its egress, it finds its way to the end of the passage, and gnawing a small round hole through the bark, effects its escape.

The Beetle is black with the edges of the wing covers and the thorax pale chestnut brown. On each wing cover there is a rather large white spot beyond the middle, and two smaller anterior spots, which are sometimes ash-grey and sometimes yellowish. The antennæ, which are shorter than the body, are pale brown, thickly clothed with short ash-grey hairs. The under side is black and sparsely covered with short grey hairs.

Dr. Fitch describes two parasites which he found attacking this pest in the larval state, one a small ichneumon fly, the other that of a small two-winged fly. Hence, secluded as it seems to be within the centre of the currant stem, it is unable to escape the acute instincts of its enemies, who searching it out, feed on its body and cause its death.

As these worms remain in the dead stalks throughout the winter, their destruction is easily compassed by breaking off all the dead wood to the surface of the ground and burning it.

The imported currant borer is a pretty little wasp-like moth with a bluish black body crossed by three narrow golden bands. It flies only during the warmer part of the day and is very active in the hot sunhine. The female lays her eggs singly near the buds, and when hatched the young larvæ eat their way to the central part of the stem as in the insect just described, but instead of being footless this grub has sixteen feet, which are of a brown colour while the body is fleshy white.

ON THE *ELATERIDÆ* OR CLICK-BEETLES.

BY W. HAGUE HARRINGTON, OTTAWA.

This extensive and interesting family of *Coleoptera* has hitherto had but little attention devoted to it in these Annual Reports. Yet, it is one which deserves more than the passing mention or description of a species, and the present paper is intended to call the attention of our Agricultural readers to a large group of insects, which are now in some measure destructive, and which may become far more so in the future. The facts will be presented in as plain and untechnical a manner as is consistent with the scientific requirements of the case.

These beetles belong to the thirty-fifth family in Le Conte's classification of *Coleoptera*, and are a sub-division of the *Serricornes* of Latreille, being classed with the *Sternoxi* (sharp-breasted). They are very nearly related to the family *Buprestidæ*, which were so fully described in last year's Report by Mr. Fletcher, differing, however, from the Buprestians in being much more flattened and elongated, and less hard. They also have the hinder angles of the thorax prolonged in sharp points, which prevent any lateral movement of it. The thorax in most cases is very loosely articulated to the meso-thorax, allowing considerable motion upward or downward of the front part of the body.

The pro-sternum (breast-bone) of the Buprestians was mentioned as being prolonged backward into a point or spine, and this spine-like pro-sternal process forms one of the most striking characteristics of the click-beetles. Our great teacher in scientific nomenclature, Linnæus, gave to these beetles the name Elater, (from a Latin word meaning to "bound,") but this name is now strictly limited to one of the many genera comprised in the *Elateridæ*.

The family is one very easy to determine, as the species preserve a marked resemblance to each other, varying but little in general shape, and going to no extremes in size or colouring. Glancing at a collection of them, it will at once be seen that there is a preponderance of dull black or brownish species, with occasional touches of red or yellow, but none are so brilliant as forcibly to individualize themselves by mere gay tints. Roughly, they may be said to vary in size from a quarter inch to two inches.

They have been named click-beetles, skip-jacks, spring-beetles, snap-bugs, clickers, snap-beetles and blacksmiths, from their power of leaping from their back, or from the clicking noise which attends such a performance. By the celebrated Swammerdam they were called grasshopper or locust-beetles.

As already stated, they belong to the great tribe of Serricornes, or "saw-horned" beetles, so named because the inside of the antennæ presents a notched appearance, from the joints having the tips more or less projecting. Their antennæ are eleven-jointed, except in a few rare instances where an extra joint is found, and are placed widely apart. In some genera they can be laid back under the thorax in grooves excavated along the margins of the pro-sternum so as to be beautifully hidden and protected. The great majority of genera have these members of moderate length, and but slightly serrate; but in some few genera they are longer and pectinate, especially those of the males.

Click-beetles have rather short and slender legs, which can be folded very closely to the body when the insect is alarmed. One of their most marked peculiarities of structure is the spine into which the pro-sternum is produced. It is to be found between the first pair of legs, and usually lies so hidden in a groove excavated for its reception in the meso-sternum, that its use and importance might at first sight not be apparent. When, however, the beetle falls, or is placed upon its back on a surface too smooth for any projection to be reached with its short legs, the service rendered by this curious piece of mechanism will soon be seen, for when the beetle has vainly endeavoured to right itself by the use of its feet, and finds itself as helpless as a turtle in a similar predicament, it bends back its thorax and head until its arched body rests only on the back of the head and the tips of the elytra (wing-covers). By this movement the spine is released from the groove or socket into which it so neatly fits; then by smartly bending up the thorax again the projection is forced back into its receptacle. This is not so easily accomplished as its withdrawal. It appears to catch for an instant upon the margin of the groove, but by reason of its elasticity bends and springs in with a sudden jerk, producing the snap or click which is heard. The consequent sudden impact of the elastic elytra on the hard surface tosses the beetle several times its own length into the air, the height being greater as the substance on which it rests is smoother and harder. If it does not fall upon its feet the operation is repeated until the desired effect is accomplished.

Elaters may be roughly classed in two groups according as the larvæ are found feeding on the roots of plants (usually under ground) or in old and decaying wood, or under bark. The majority of the first, and a few of the second class are decidedly obnoxious insects, while the rest are more or less beneficial.

The eggs of the root-feeders are thought (although the fact has, so far as I know, never been actually determined by observation), to be laid on or among the roots or stalks of plants, either in the ground or just at its surface. They are very minute globular, or partly oval bodies of a yellowish-white colour and produce almost invisible slender grubs, which even when full grown are seldom more than an inch long.

In England these grubs have received the name of "wireworms," from their slenderness and hardness, and the same term is applied to them in this country. It is also incorrectly applied sometimes to the millepedes or myriapods, such as the *Julus*, which is found under stones or in wet wood, etc., and is often from two to three inches long. These are not true insects and are easily distinguished from the larvæ of the clickers by their many feet, the *Julus*, for instance, having over fifty pairs.

The larvæ of elaters more nearly resemble in shape the well known meal-worms, or grubs of the beetle called *Tenebrio molitor*. They have twelve segments besides the head, and have six true legs; also a prop-leg or tubercle on the least segment. They are semi-cylindrical, being rounded above and flattened beneath, and are cased in a very hard, horny covering, which affords them a most efficient protection from the attacks of their smaller enemies, and also enables them to burrow easily and rapidly through light soils.

Such larvæ as live in decaying or old wood are broader and more flattened and in some cases much larger than the earth burrowers. The eggs are probably laid in crevices of the bark or wood in which they undergo their transformations. These larvæ may be said to be beneficial in so far as they, with those of many other tribes of insects, aid in destroying and removing the decayed and prostrate vegetation, and thus make way for new growths.

I am not aware that any very marked damage has as yet been inflicted upon the crops in Canada by the larvæ of these beetles, but in the British Islands they have been accused of committing alarming depredations on grain, root crops and garden produce of various sorts. Much attention has been given to them by Curtis in his exhaustive treatise on "Farm Insects," and also by many other well-known entomologists. A number of species are described, four of which appear to be specially obnoxious and destructive. The larvæ live some years, perhaps as many as five, and moult, as do caterpillars, three times before entering the pupa state. This change takes place in a small cell some distance under ground, and in a few weeks the beetles emerge to a higher but much briefer existence, and are found upon various flowering plants, etc.

The four species so notorious for their ravages belong to the genera *Athöus* and *Agriotes* of *Eschscholtz*, which are represented in this country by a number of species, having probably similar habits to their old world kindred.

There is scarcely any land free from them or any crop that is not subject to their voracity. They occur wherever grass will grow, being particularly harboured among clover roots, and are always prevalent in meadow and pasture-lands, seeming to thrive best in the vicinity of swamps and woods. When lands are broken up the first crops sown are often almost totally destroyed by the larvæ which infest it and remain in it for some years afterwards.

Young oats, wheat, rye, barley, etc., suffer much from being partially or entirely cut off below the surface; the wireworms destroying manifold the amount actually devoured. Wood says that while only eating one-tenth as much as a similar sized caterpillar, each wireworm destroys ten times as many plants. Hops, cabbages and many root-crops are also injured; turnips, perhaps, more than any, as they are cut off when young, and have the roots badly eaten into when larger, as many as twenty or more grubs having been found at one turnip.

Conflicting opinions are held as regards the liability of potatoes to be attacked. Some even propose the use of slices of these tubers, among other substances, as traps to entice the wireworms to in gardens. On the other hand evidence has been often adduced to prove that land sown with potatoes was in a great degree cleared of infesting larvæ, which it was asserted do not touch the potatoes and are consequently starved out.

In gardens, the wireworms destroy salads, etc., and the gardener has also often to lament the loss of his beautiful flowers, such as carnations and lobelias. The list of cultivated plants attacked by them could be greatly lengthened, and it is fortunate for Canadian farmers and gardeners that as yet they are not so abundant and destructive here. Nevertheless considerable damage is done to many crops on this continent, and the late esteemed Dr. Asa B. Fitch (one of the greatest of American Entomologists) has treated of wireworms—see his 11th Report—almost as exhaustively as Mr. Curtis. It appears that Indian corn, one of the largest and most important crops grown in North America, is the greatest sufferer, especially when (as is usually the case), it is the first crop planted in new land, or when the season is cold, wet and late. The seed corn is attacked by the wireworm, which bores its way into the kernel and is often found half buried therein when the hills are examined. Upwards of thirty or forty have been found in a single hill, and nearly the whole of the seed planted is sometimes destroyed. The still more valued cereal, wheat, does not escape serious attacks, and, as in England, *all* crops are more or less liable to be damaged. An exception may be made in favour of buckwheat, which has been strongly asserted to rid the land of them, but there are doubts as to its efficacy in so doing, as well as many objections to it as an uncertain and inferior crop. All kinds of grasses, from the choicest timothy to the coarsest swamp sedges seem to be the chief and favourite diet of wireworms; so that grass and meadow lands are badly infested for a year or two after being broken up.

Dr. Fitch was of opinion that the wireworms of this country do not live more than two years (instead of five), as it is only for that length of time that new fields are so much infested with them.

As the country becomes more densely settled, and, through the breaking up of the waste lands, they are gradually deprived of their natural food-plants, they may come to be equally abundant and voracious amongst us as in England, so that it may be well briefly to mention the measures adopted to destroy them there.

For gardens or small lots hand picking is most strongly recommended as the surest way of ridding them of these vermin; but where labour is so scarce and dear as in this country, such a measure is hardly feasible. By this method 18,000 wireworms were gathered from a field of one and a half acres, and in another instance over 60,000 from an area of three acres. Women or boys were employed to traverse the rows of plants, loosen the soil around the roots, put all the wireworms into jars, or other suitable vessels, and press down the soil around the roots.

One of the most successful remedies on a large scale is a mixture consisting of two parts of quicklime, three parts of soot, and one part of coarse or refuse salt. This is used as a top-dressing, being applied immediately after compounding, and should be well rolled in. It has the advantage of being perfectly harmless to the crops. Indeed it is a most excellent and powerful fertilizer, as well as a destroyer of all kinds of insects and many weeds. Refuse from gas-works, nitrate of soda, rape-cake, and chloride of lime, mixed and spread with manures are highly recommended, and the sowing of soda-ash or guano broadcast when planting.

A previous crop of white mustard is claimed to clear the land of them, presumably by starving out, for the roots of the mustard are extremely acrid, and of course occupy the soil to the exclusion of any more nutritive ones. A close grazing by sheep seems beneficial where pastures are badly infested, perhaps because the surface is trodden down too hard for the larvæ to work through, or because the beetles are prevented from laying their eggs, or have them destroyed. The same result is also obtained by compacting the surface by heavy rollers.

There are also means of striking directly at these pests which at the same time are of more general utility, and whose adoption cannot be too strongly urged. Aside from any mere questions of a taste for order, neatness and beauty, the practical wisdom and advantages of keeping land thoroughly worked and cleaned are plain to everyone; it does not pay to leave neglected a single square yard of the farm.

The larvæ of these beetles, in common with hosts of other insects, find a pleasant refuge in the uncultivated patches left about the farm, and under or among stones and other rubbish. Farmers cannot bear this too constantly in mind, and they should strive to have their fields, as well as gardens, free from all unnecessary disfigurements of such kinds. The entomological collector may delight in the rank growth of all manner of shrubs and plants along the fences and ditches of his neighbours, for he generally finds a rich variety of specimens thereon; but what is his gain is usually the owner's and the country's loss.

Leave no such strips along the fence-rows, nor of stubble in the fields. Let all loose boards, stones, logs, brush and rubbish of every kind be removed, and thus, as far as possible, prevent insect foes, from harbouring about the fields; there will be plenty of them without furnishing such breeding and hiding places.

Above all, learn to protect all their natural enemies, among the most powerful of which are the birds. It is really disgraceful (and saddening to such as love and value these bright little creatures) to see the merciless way in which they are shot and trapped around this city (Ottawa), and I fear the same indiscriminate "slaughter of the innocents" takes place all over the land. All those that are known to be insectivorous should be vigorously protected and encouraged, even if occasionally they do exhibit a tendency to a vegetarian diet and pilfer a few berries and seeds.

Robins, thrushes, blackbirds, sparrows, etc., may be always seen searching and pecking vigorously among the grass for elaters and other insects, while numerous species are searching for them in all other situations. It has been estimated that an English rookery, of 10,000 rooks, consumes annually about 200 tons of worms and insects. Now, our much-abused crow, a brother of the rook, is just as active and voracious a bird, and feeds its young (according to Fitch) almost solely on elaters and their larvæ. Thousands of these are probably consumed by the young crow before it even leaves the nest to hunt for them itself.

Toads and frogs live also mainly upon insects, and being nocturnal in their habits—as are so many insects—they form the night relay, working to save the crops while the birds are at rest. Turkeys, ducks and other poultry may profitably be allowed to run in grain fields at suitable seasons, while among root crops they can seldom do any harm, and devour immense numbers of all kinds of insects.

In breaking up new land it is well to burn the turf, and the destruction of many insects, in their various stages, is undoubtedly accomplished by the process of burning so generally in use in this country.

When the elaters reach the perfect state, they are entirely harmless beetles (except that they lay the eggs for future broods), and are found upon flowers, grass, stumps, trees, fences, etc., and when they are approached they have a very common habit of dropping from their resting-place, so that it is often almost impossible to find them. They walk slowly, but can fly well, and do so both by day and night, seldom, however, making long flights, rather preferring to remain in the vicinity of their former feeding grounds.

As it is not proposed to attempt in this paper any scientific classification or description of the many genera and species comprised in the family *Elateridæ*, the remainder of this paper will be devoted to a few brief remarks on some of the more interesting foreign and native ones.

Westwood states that the Elaters are less rich in species than the Buprestians, but that they are more generally distributed. About four hundred and fifty North American species are given by Le Conte in his classification, of which, perhaps, one-fourth are found in Canada. During the past summer I collected in the immediate vicinity of Ottawa fifty species, while of Buprestians I only obtained about half that number.

There are perhaps no click-beetles that in form, size or markings are striking when compared with many other families of beetles; they vary but slightly in shape, are of moderate size, and of dull hues generally. One genus, however, (*Pyrophorus*, containing 30 or more species) is indeed worthy of notice from the power of light-emitting possessed by its members. If sombre by day they are the brightest of all insects when darkness shrouds the world. I have before me a specimen of *P. noctilucus*, the celebrated "fire-fly" of the West Indies and Central America, called by the Spaniards *cucujo*. Figure 51 represents this insect both at rest and on the wing. It is nearly an inch and a-half long, (the elytra being exactly an inch from base to tips,) and has a tawny grey appearance, caused by a covering of short yellowish hairs on a black surface.

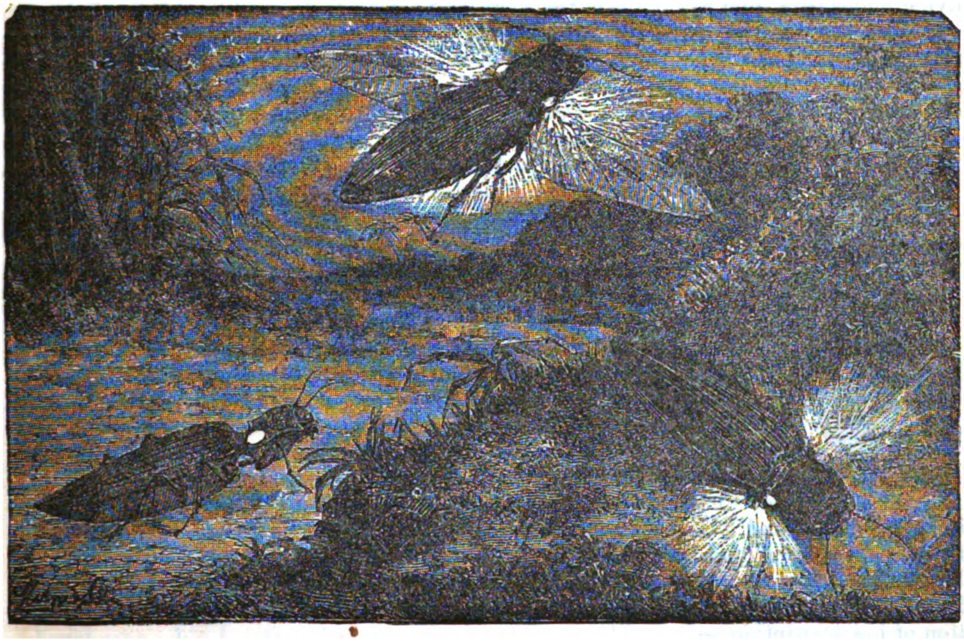


Fig. 51.

Its most important features are two smooth, convex yellow spots, or tubercles, on the thorax—one on either side—from which at night, when the beetle is alive, streams a strong greenish light, far surpassing that of our own "fire-flies," or, correctly speaking, "fire-beetles." When the beetles are on the wing another patch beneath the body emits a bright orange-tinted light.

These beetles and their larvæ feed on the sugar-cane and do great damage to the plantations, being in some places very numerous, so that the air at night is starred in every direction with their myriad meteor-like fires. The natives, ever ready to connect the visible with the unseen, call them, not unpoetically, the vehicles of departed souls, or in other places they are said to be the souls themselves flitting about the earth they have left, so that to kill one might be to crush the soul of a departed friend. Such beliefs in connection with certain insects, snakes, and other animals have often been prejudicial to savage welfare by protecting obnoxious creatures from destruction.

P. pysoderus is a much smaller beetle, being but three quarters of an inch in length. Its colour is a dark brown; the hinder angles of the thorax are produced in acute spines, and the tubercles are not prominent. It is common in the Southern States and emits a light equal in intensity to that of our native "fire-flies," but constant instead of intermittent.

In the Phillipine Islands is found a very large species of Elater, called *Oxynopterus* (sharp-winged) Cummingii. It is a large, reddish beetle and the male has fine pectinate antennæ. The prosternal spine is stated by Wood to be as large as a crow-quill, and three-fourths of an inch long, so that its powers of leaping and clicking must be well marked.

The genus *Pachyderes* is distinguished by having the thorax twice as broad as the elytra; *Semioti* has the tips of the elytra spined; and the males of *Macromalocera*, from Swan River, Australia, have the antennæ as long or even longer than the body.

Of seventy species found in Great Britain, the largest is *Ludius ferrugineous*, a dirty red beetle about an inch long.

Turning now to Canadian beetles, the first sub-family is named *Eucnemidæ*, and comprises a few small compressed beetles found under bark or on leaves, and rather uncommon. Wood says that the prothorax in these species fits too tightly against the base of the elytra to admit of them leaping, but Le Conte claims for some a feeble power to do so. The second sub-family *Cerophytidæ* consists also of a few species of small beetles, living under bark, and rarely, from their size and habits, seen or captured.

The third and last bears the family name—*Elateridæ*—and includes all of our remaining species. Of these the largest and most striking examples are contained in the genus *Alaus* (meaning "dull" coloured). There are four species found in Northern America, viz.: *Melanops*, *Gorgops*, *Occulatus* and *Myops*, of which the two last (at least) are found in Canada. *A. occulatus* (Fig. 52), must be familiar to nearly all my readers, and is the largest of our Elaters, varying in length from one and a quarter inches to one and three quarters.

Its general colour is a deep glossy black; the under surface of the body, and the legs being thickly powdered with white. The broad, almost square, thorax is also powdered (but usually much rubbed), with the exception of two large, oval spots of a rich black velvety appearance, and rimmed with white so as to seem like great staring eyes, often causing the thorax to be mistaken for the head by those ignorant of an insect's construction. These beautiful markings have determined its specific name; for *occulatus* is simply the Latin form of "eyed." The elytra are marked by longitudinal, impressed lines, and are sprinkled with bright white spots, of the same powdery substance which covers the rest of the body.

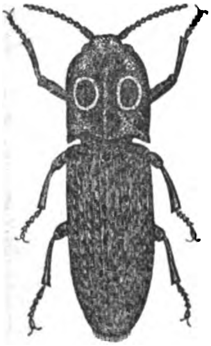


Fig. 52.

In early summer it is found crawling slowly, or sunning itself on trees, fences, buildings, paths, etc., and is easily captured. In Duncan's "Transformations of Insects" the larva is shown crawling on the ground, and the pupa in a cell beneath the surface, but Dr. Harris states that "it undergoes its transformations in the trunks of trees." He found them in old apple trees—the larvæ feeding upon the wood. The following is a portion of his description:—

"These larvæ are reddish-yellow grubs, proportionately much broader than the other kinds, and very much flattened. One of them, which was found fully-grown early in April, measured two inches and a half in length, and nearly four-tenths of an inch across the middle of the body, and was not much narrowed at either extremity. The head was broad, brownish and rough above."

Soon after the grub was found it cast its skin and entered the pupa state, and at the proper time emerged as a beetle.

A myops is a somewhat smaller and less robust beetle, and varies more in size, some in my collection being only one inch long. In general appearance it is much like *occulatus*, but is not nearly so handsome an insect. The markings are less distinct, the colouring more greyish, and the eye-like spots on the thorax are much smaller and duller, whence it has received its name of *myops*, or the "short-sighted" *alaus*.

It is much more common in this neighbourhood than *occulatus*. To show how readily these thoracic markings are mistaken for the elater's eyes, and the loose articulation of the thorax for the neck, I may just mention that a friend of mine brought me, one day this summer, a fine large *myops*, which he had just found on his window-sill, remarking that he was afraid it was dead, because "its neck seemed broken." I told him to lay it on its back upon my table, and the sudden snap with which it nearly sprang into his face quite startled him. The Indian name for an elater (according to Dr. Fitch) is "neck-breaker," or "the insect that breaks its neck," which gives a very good idea of its chief characteristic.

Perhaps the most abundant of our elaters is a dark brown one, about half an inch long, named *Melanotus communis*. The larvæ feed in wood, transform in the autumn, and the beetles winter under bark or in crevices, and are very common in spring. *Limonius plebejus* is also a brownish beetle, which is even more numerous in this vicinity.

Occasionally large glossy black elaters are found under stones in damp localities. These belong to the genus *Melanactes* and are remarkable for having luminous larvæ. Several species of Corymbites are numerous on pine-trees in summer, as *C. æripennis*, *C. hieroglyphicus* and *C. triundulatus*; the latter is also said to feed on the flower of the rhubarb. *C. vernalis*, a pretty beetle with a black thorax, and yellow elytra marked by five black spots, may be found sometimes in large numbers on blossoms of the choke-cherry.

In the fourth volume of the *Canadian Entomologist*, an interesting account of the wheat wire-worm, *Agriotes mancus*, is given by Mr. J. Pettit, of Grimsby, Ont., a very careful observer. Mr. Pettit says:

"For many years an insect, familiarly known among farmers as the 'wire-worm,' has committed ravages from time to time among the wheat crops in different parts of the Province. As the history of this insect has not hitherto been traced out, I am happy to be able to make public through the pages of the *Canadian Entomologist*, the following description of its larval and pupal states.

"In the fall of the year 1870, so unusual an amount of damage was inflicted upon the wheat crops in this vicinity by this wire-worm that I was led to try and breed it to the perfect state with a view to ascertaining what species it was the larva of. By digging about the roots of the wheat plants, I obtained about a dozen specimens (Fig. 53) which were placed with a few wheat plants in a large flower-pot, where they were kept supplied with food by planting occasionally a small quantity of wheat. With the first cold weather they ceased to eat, and were then placed in a sheltered situation until the return of warm weather in spring, when they were restored to the breeding-cage. They soon gave evidence of being alive, and possessing unimpaired appetites; their rapid consumption of the wheat plants rendered it necessary to renew the supply quite as often as before. They were fed in this way until the month of July, when my absence from home caused them to be neglected; on my return there was not a vestige of food left. Thinking that the worms had probably died of starvation, I paid no further attention to them until the 26th of August, when, on removing a part of the earth from the pot, a pupa (Fig. 54) was disclosed, and on the 3rd of September the first imago appeared, which proved to be a specimen of *Agriotes mancus* (Say). As only two more specimens came out during the remainder of September, I turned the earth out of the pot and carefully examined it. The inspection revealed seven specimens of the imago in the little cells in which they had transformed, and one larva.

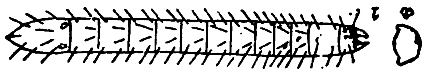


Fig. 53.

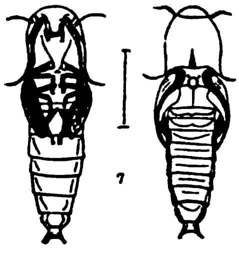


Fig. 54.

"Among the larvæ collected, I had noticed one less than half the size of the others and evidently much younger, which would account for the one still in the larval state. It had attained, however, a size fully equal to that of the others when first brought in during the previous autumn; and hence I have formed the opinion that the larval state does not last longer than three years. This opinion has since been strengthened by the observation of a large number of larva which appeared readily separable into *two sizes*, corresponding to those originally collected for breeding. Westwood, in his 'Modern Classification of Insects,' (vol. 1, 238), states respecting the larva of an allied species (*A. obscurus*) which, in Europe, feeds upon the roots of wheat, rye, oats, barley and grass, that according to Bjerkander, a Swedish naturalist, 'it is five years in arriving at the perfect state.' Curtis, in his 'Farm Insects,' (page 16,), makes a similar statement upon the same authority, and adds that those which he had himself fed for ten or twelve months scarcely increased in size during that time. As already stated, however, I am of opinion that our species is by no means so long lived, but that it attains maturity in three years, a period quite long enough, the agriculturist must think, in which to inflict damage upon the crops."

Fig. 53 shews the larva or worm magnified to about twice its natural size, and Fig. 54 the chrysalis under and upper side, also magnified—the hair line between them gives the natural size.

The perfect beetle is about seven-twentieths of an inch long, the body black, punctured with minute dots, and covered with very short hair, the head is large and black, the antennæ and feet reddish.

Adelocera is a genus comprising rather large beetles of a roughish, and often frosted, or rusty, appearance. Their larvæ feed in decaying wood and are generally found upon stumps, trees or fences.

The last genus which I shall mention here, viz.:—*Pityobius*, is remarkable from having twelve-jointed antennæ, which in the males are beautifully bi-pectinate; that is they have on each side spines, or branches, projecting from the joints. There are only two species known in Canada—*P. anguinus* and *P. Billingsii*—and the beetles are exceedingly rare, while but little is known of their habits.

P. anguinus "is of a dull black colour, with short brown hair." *P. Billingsii* (named after its discoverer, the late Mr. Billings, of Ottawa), has rich and rather glossy black elytra, longitudinally lined, and wider than the thorax. The head and thorax are also deep black but are roughened; the legs and under parts are less black. The head is nearly square above; the eyes are very prominent, being far more conspicuous than in any other of our elaters, which I have seen.

The specimen now before me is about one and a quarter inches long and is decidedly the handsomest click-beetle in my collection. It is probably the second specimen captured and the only one now in a Canadian collection. The larva of this beetle lives in decaying wood, for I found a pupa almost in the heart of an old rotten log, two years ago. Unfortunately the wood in which I kept it was allowed to become too dry, and in consequence the elytra never expanded properly and the specimen was destroyed.

Let me conclude with a few words of advice, which have often been spoken by others, but which will bear repeating. Every farmer and gardener will consult his best interests by paying close attention to all the insects which he finds about his land, and by striving to learn something of their habits. When a strange insect or larva is discovered, endeavour to place a specimen in the hands of the nearest entomologist, who will be always glad to inform you whether its habits are injurious or beneficial to plant-life, or, if they are unknown to him, to try and find out what they are.

THE PLUM CURCULIO (*Conotrachelus nenuphar*).

By B. Gott, Arkona.

[Figure 55 represents this insect in its various stages, *a* the larva, *b* the chrysalis, *c* the perfect beetle all magnified. The hair lines at the sides shew the natural size.]

For some considerable time past I have closely watched the operations of this familiar insect, and my only apology for bringing again this hackneyed theme to the notice of the public, is that the growing importance of the subject appears to demand it. I purpose to shew in this paper that our fruit is at present in more danger from the depredations of this insect, than from any other single enemy operating on it. Notwithstanding all that has been said and written about this pest, and the good advice which has been given for its destruction, yet comparatively little is done systematically

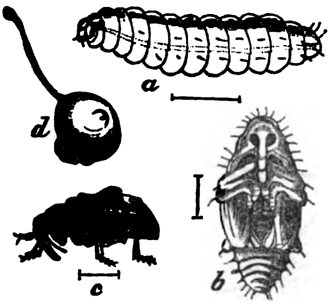


Fig. 55.

to destroy it. With the view therefore of directing special attention to the losses resulting from neglect of the remedies at hand, I shall as briefly as possible review the whole subject of this insect and its work, as well as the remedies which have been suggested for it. This insect was first described by Herbst, a German Entomologist, as early as the year 1797. It is a foreign aggressor but the date of its introduction is not known. It is thus ably described by Dr. Harris, in his "Insects Injurious to Vegetation," a work that should be in the hands of every fruit-grower and agriculturist:

"This weevil, or curculio as it is often called, is a little rough, dark-brown or blackish beetle, looking like a dried bud when it is shaken from the trees, which resemblance is increased by its habit of drawing up its legs and bending its snout close to the lower side, of its body, and remaining for a time without motion, and seemingly lifeless. It is from three-twentieths to one-fifth of an inch long, exclusive of the snout, which is rather longer than the thorax and is bent under the breast, between the fore legs, when at rest. Its colour is dark-brown, variegated with spots of white, ochre-yellow and black. The thorax is uneven; the wing covers have several short ridges upon them, those on the middle the of back forming two considerable humps of a black colour, behind which there is a band of ochre-yellow and white. I have found these beetles as early as the 10th of March, and have frequently caught them flying in the middle of the day. They begin to sting the plums as soon as the fruit is set, and continue their operations till the middle of July, or as some say, until the first of August. In doing this the beetle first makes a small crescent-like incision with its snout in the skin of the plum, and then turning round, inserts an egg in the wound. From one plum it goes to another until its store of eggs is exhausted, so that where these beetles abound not a plum will escape being stung." There is some difference of opinion among Entomologists as to the number of broods matured in a season, but I think that with us there is but one brood, and these the result of insects emerging from the ground in early spring.

Its relation to fruit culture is very intimate, and the whole aspect of fruit growing is affected more or less by the existence of this troublesome foe, to the great discouragement of plum, apricot and nectarine culture, estimable fruits where they can be successfully grown. We cannot, as some have done, tolerate this insect as a serviceable thinner of the fruit, for we have found it to be a most relentless destroyer. The female insect makes a crescent shaped incision in the fruit and deposits there a tiny egg which soon hatches; the young and tender grub at once works its way to the germ of the fruit and revels in its nutritive juices. The seed germ being mutilated, a vital point is attacked, the fruit loosens its hold on the tree and soon falls to the ground. This is exactly what is needed by the larva for its development and subsequent escape. If the fruit had dried up and maintained its hold on the tree the grub would probably have perished. On the ground the fruit is kept cool and moist and as soon as the grub is fully grown it leaves the fruit and enters at once under the soil where it is shortly changed to a chrysalis and patiently waits in obscurity its perfect development.

Its rapid increase is a matter of concern to all growers of the plum as it is spreading rapidly over every part of the Province where this fruit is grown. At a recent meeting of the Fruit Growers' Association of Ontario one of the members present observed that "A few years ago there were no curculios at Goderich, now they are there in full force; and plum growers are discouraged. It is not yet at Owen Sound, but it will be by and by." Thus it is gradually widening its field of operation and annually increasing in numbers. On my own grounds as well as on those of my neighbours, this fact has been painfully evident during the past year; not a tree has escaped, and even the peach, cherry, pear and apple were attacked.

So far as we know in this country the curculio is almost exempt from the attacks of insect enemies. In the report of the Entomological Society for 1876 mention is made of two parasites which have been discovered by Prof. Riley operating on this insect in

Missouri, namely, *Sigalphus curculionis* (Fig. 56) and *Porizon conotracheli* (Fig. 57). I am not aware that these friendly insects have yet been taken in Ontario, but it is quite possible that they may be working unobserved among us. A detailed description of both these insects may be found in the Report for 1876.

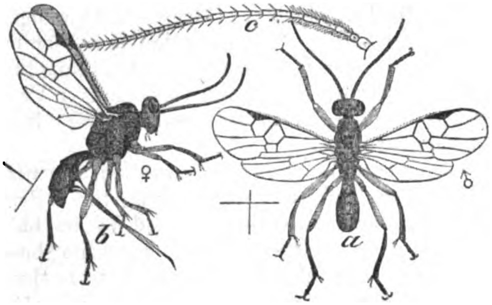


Fig. 56.

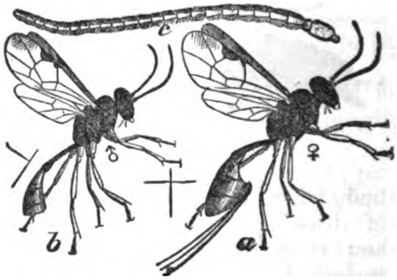


Fig. 57.

As already stated the curculio does not scruple, in the absence of the plum, to attack the peach, pear and apple. I was greatly amused during last season in watching the *little Turk* at his work upon our young pears and apples. I had a favourite pear tree the fruit of which I had never before seen, which blossomed nicely and set some five specimens, leading me to hope that I should be able to test their qualities when mature, but in a few days, lo the crescent! the familiar distinguishing mark of our fruit enemy was already seen upon them, and in time they all fell prematurely from the boughs. In many instances the same insect was noticed working upon the apples. As I was gathering in my winter apples, a few days ago, I came to a Northern Spy tree, a very large proportion of whose fruit was exceedingly ill-shaped, especially all around the lower branches. The fruit was disfigured by deep indentations and corresponding swellings or knobs. Upon examination it was found that those indentures on the fruit contained the mark of the familiar crescent of the plum curculio which probably will account for their deformed appearance. It would appear that the insect had cut the tender skin of the young fruit, which had interfered with the circulation and development in that place. The egg deposited had not hatched, or if it had the little grub had died. The crab-apples were by far the worst affected; scarcely a sample matured on many fine trees, and a number of fine young Tetopsky apple trees were totally deprived of their promising crop by the same enemy. Under such circumstances constant vigilance is necessary to secure a crop of fruit, and if the annual increase of insect life goes on unchecked it is easily seen that good fruit will become scarce and more expensive.

The remedies which have been recommended are numerous, and may be divided into two classes, viz., those that kill and those that merely deter. Under the first class may be mentioned jarring the trees and gathering up the insects. This is by far the best remedy at present known. P. Barry, in his excellent work "The Fruit Garden," says that this method was first recommended by David Thomas, forty years ago, and that on their extensive grounds it is successfully carried out. Mr. Downing also speaks highly of jarring, and recommends that it be repeated daily as long as the insects continue to make their appearance. Repeated trials have proven beyond question that this rather tedious mode is a very effectual one if persisted in. At a late meeting of the Fruit Growers' Association of Ontario, at Sarnia, Mr. James Lambert, of Sarnia, said: "He had tried the jarring plan with three trees and these were breaking down with fruit." Page 33, of 1878. In the November number of the *Gardener's Monthly*, just at hand, it is related of Mr. Cobleigh and Mr. Willard, of Geneva, N. Y., who are noted and extensive plum growers, "They practice shaking the trees, but their method is different from any one we have met with before. They have two light frames on which light muslin is spread. They look like huge barn doors but they are very light. These are placed under the trees when they are to be shaken. Then they have a long handled sort of crutch; the arm-rester as we would say if it were a crutch, being nicely padded to prevent injury to the bark. This is pushed up and the branches jolted and the "little Turk" comes down and is killed by the boys when it falls on the muslin. This is better than the old plan of striking on the trunk. It has to be done every day, and it would be as well twice a day. Mr. Cobleigh finds it takes two hours and-a-half to shake 1,600 trees. Abundant evidence is forthcoming to establish the efficiency of this remedy.

Another method suggested is to plant the trees in swine or chicken yards, a plan which has also been highly recommended. At the meeting of the Fruit Growers' Association already referred to, Mr. James Dougall, of Windsor, said, "I find that a hen and her chickens cooped under the trees, devour a great many curculios, and secure me a crop of plums." We would, however, rather allow the fowls free roving over the fruit yard at will. The Hon. Mr. Vidal, of Sarnia, said that "Mr. Baubee made a hen-yard around his plum trees, and had no more trouble with the curculio." Mr. Barry says "planting the plum orchard adjoining the hog-pen is probably the easiest and best way of securing a crop of plums." Mr. J. J. Thomas in his admirable work, *The American Fruit Culturist*, page 155, says, "experience has thoroughly established the efficiency of this method" (the confinement of swine among the trees of the plum orchard), and adds, "geese and hens are to a limited extent useful in repelling or destroying the curculio." Again the late Dr. Kirtland, of Cleveland, Ohio, says, "This insect in one season destroyed every plum on my farm, excepting the crop of one tree in my swine lot; that tree is bending under its load of fruit." Here we have excellent evidence of the efficiency of this remedy; we would say, plant your plum trees together in a lot by themselves, and securely fence them, then as they begin to bear fruit, keep a sufficient number of hogs or fowls in the yard during the curculio season. Some cultivators are in favour of keeping hogs thus confined in the orchard during the whole of the summer season, as it is thought they greatly benefit the soil by their constant rooting and stirring of it. These two are doubtless the most valuable and efficient remedies known.

Careful picking up of the fallen fruit should, in every case, be attended to where hogs or fowls have no access, and this before the larvæ of the curculio have had time to escape into the ground. After being gathered they should be burnt or otherwise boiled or steamed and given as food to swine.

The second class of remedies are those which merely deter the insect from attacking the fruit. Planting the plum trees on hard, clay soil has been recommended as a preventative measure. Mr. Downing says, "we have never known an instance of the curculio being troublesome in a heavy soil." This statement has been confirmed by observation in my own neighbourhood, where I have noticed that on heavy clay soils a crop of plums can usually be secured, and there are hundreds of acres of just such soil where I believe that thousands of bushels of fine fruit might be annually produced.

It has also been recommended to plant plum trees close beside water-courses to prevent the attacks of curculio, and there are many who have faith in it; we have seen trees so planted perfectly loaded with fine fruit, although there was no water flowing at the time. There are some, however, who deny the efficacy of this measure. J. J. Thomas says "it was formerly supposed that the instinct of this insect would prevent it from depositing eggs on branches hanging over water, but recent experiments prove that it possesses no such sagacity."

Covering the ground under the tree with lime, plaster, ashes or salt have been used to prevent the attacks of curculio, and in many cases with apparent success. Very recently Mr. M. Watson, of Thedford, told me of a friend of his who had tried plaster; he covered the ground under the tree with it and saved his crop of plums. There is also evidence that salt is useful when properly used. Mr. Downing refers to instances where it has been used with complete success; he says, "the best method of applying salt for the plum weevil is to strew it pretty thickly over the surface when the punctured plums commence to drop." The use of lime is advocated in a similar manner; some also are in favour of ashes.

Employing offensive odours in the form of smoke from oil or tar has also been well spoken of, but these measures are of very doubtful efficacy, and if the insects were thus driven from one part of the fruit crop they would usually take to another.

Making the ground hard and difficult to penetrate under the trees by plastering with mortar or paving with stones or shells are measures which have been advocated. Mr.

A. Watson in the *American Home Garden*, says that the most promising remedy is to "pave closely under the tree with clam or oyster shells, the instinct of the insect leading it to avoid depositing its eggs in fruit from which, when they drop, its progeny can find no safe retreat." Mr. Downing speaks of plum trees growing in hard trodden court-yards which usually bear plentiful crops. Some have also recommended the use of chips and small pieces of wood placed around the trees as traps for the curculio, but it is very doubtful if any of these methods will ever take the place of jarring.

NATURE PRINTED BUTTERFLIES.

BY JAMES FLETCHER, OTTAWA, ONT.

The season of warm days, flowers, and butterflies is over now, and the look-out is cold, bleak and bare. Apparently there is little for the scientific lover of nature to do in the way of collections at this time of year; such however is far from being actually the case, as all who have collected will testify. It is in fact one of the busiest seasons for collectors. All the treasures gathered during the summer months have to be *gone through.* In the first place those known have to be taken out and sorted away into their proper places in the cabinet; the remainder then have to be re-sorted and divided up into sets according to the families to which they appear to belong, and after this they have to be examined critically and if possible identified. It frequently happens that a collector of butterflies has an opportunity of capturing a large number of some local species, in one day, and finds it impossible or irksome to set them all before they become too dry, as they will in a very short time in hot weather. When they are once dry, too, one is apt to think that as they can get no worse they may safely be put aside until some more convenient occasion to be relaxed and set up, but this convenient occasion, like a good many others, is sometimes very long coming, and many valuable specimens are thus lost. An accident which occurred to the glass of one of my butterfly cabinet drawers lately, was the means of reminding me of a process shewn me some years ago by a Captain Lloyd, of the English Navy. The accident referred to was the breaking of the cover of one of my cases which contained some rare butterflies, in consequence of which it was impossible to close the door of the cabinet tightly. My horror can be better imagined than expressed when, upon opening the door and pulling out this drawer, about a fortnight afterwards, I found that there was not a single perfect specimen in it—a mouse had got in and what was once a neatly arranged case of butterflies was now nothing but a chaos of nibbled bodies, loose wings, pins, and labels. I had not the heart at first to throw out these fragments and so wipe out entirely the pleasing recollections each brought up in my mind of rambles through the woods and in the country; so carefully gathering up the wings I put them away in a little box. The idea then struck me of printing them as I had seen my old friend do them—and as I think it would be a very convenient way for Entomologists and agriculturists to send butterflies for identification, when spare duplicates are to be had, I am induced to send a description of the *modus operandi.* Take the insect in your left hand, holding it beneath the thorax, then with a pair of sharply-pointed scissors cut off the wings as close to the body as possible; occasionally, unless the scissors are very sharp, some of the muscles are torn away from the thorax with the wings, these must be carefully removed; arrange the wings in pairs and put them with the body on one side in some convenient place where they may be easily got at when you are ready for them. Now take a piece of white paper of the size required, and fold it in two like a sheet of note paper, then with a camel-hair brush lay on a thin wash of perfectly clear gum arabic, fold down the upper half and pass the hand lightly over it so as to spread the gum evenly between the two sides; now re-open it, and taking up the wings with the tip of the brush, the lower ones first, arrange them carefully in the position wanted, leaving space enough intervening between the two pairs to paint in the body afterwards. Spare no pains in arranging the wings; this corresponds with "setting" for a cabinet. I have seen many good collections of insects, made by amateurs, rendered almost useless by the want of a little thought on this point. The proper position for a butterfly to be set in is that which it takes when sunning itself. Copy nature, and you cannot go wrong. When the wings are quite even, gently fold down the upper half of the paper and put your specimen under a heavy weight or in a press until quite dry—I generally leave mine for some hours at least. When it is quite dry take it out and place it against a window-pane, so that the butterfly may be clearly defined against the light. Now, very carefully draw a line with a black lead pencil round the edge of the wings, then lay it down on an even surface, and paint with clean water all over the part outside and up to the outline. After a few minutes the water will saturate the paper and dissolve the gum ; the two sides will, then separate easily, and this being done it will be found that on one side is a perfect representation of the upper side of the butterfly, on the opposite another of the under side, and loose between these a perfectly clear horny membrane ; the explanation of this is, the upper ends of the scales are adhering to the gum, and what we now look at are the lower ends or roots. When painting with water, to dissolve the gum, great care must be taken not to let it run over the outline on to the wings, or else the scales will not adhere to the paper, but will remain on the membrane.

The work is not yet finished, however ; a most important part has still to be done ; this is the filling in of the body and antennæ ; the easiest way to do this is with a fine pen and some water-colours. Place the body, from which the wings were severed, before you and copy it, taking particular notice of any characteristic markings, as for instance, the colour of the eyes, legs, or antennæ. When finished, cut it out with a pair of sharp scissors, paste it in an album and write a short description of its capture, giving the date, locality and any other interesting circumstances connected with it. I have found it is easier to put in the antennæ after the prints are gummed into the collection as on account of their fragility, they are difficult to cut out neatly. Should the collector happen to be an artist, a most beautiful collection may be made in this manner by painting pretty designs with flowers for each species, and gumming the butterflies in, in natural positions ; of course too, its scientific value will be materially increased if those plants are introduced to which the insect is most partial, and when possible, a sketch of the larva and pupa is added.

The chief advantages of this process are, the ease with which it is done ; the great convenience with which the specimens are preserved or transmitted through the post for identification or exchange ; their great durability, for they will stand much rougher handling than specimens preserved in the ordinary way ; and more important than all these the fact that if you have only one specimen, you can shew both the upper and under sides at once, and also the membranous skeleton of the wings, which can thus be very easily examined and makes a beautiful object for the microscope ; moreover, if you have only an imperfect specimen it is possible to preserve a good likeness of it by filling in the wanting parts with water-colours ; and further, it does not matter how old your specimens are ; I have some prints which I have taken from butterflies collected in India more than twenty years ago which are quite as good as others printed on the same day that the insects were caught here.

4970. Apr. 16, 1881.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF THE

PROVINCE OF ONTARIO,

FOR THE YEAR

1880.

H. Hagen.

Printed by Order of the Legislative Assembly.

Toronto:
PRINTED BY C. BLACKETT ROBINSON, 5 JORDAN STREET.
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ELEVENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

INCLUDING REPORTS ON SOME OF THE NOXIOUS, BENEFICIAL AND OTHER INSECTS OF THE PROVINCE OF ONTARIO.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE,
BY THE OFFICERS AND MEMBERS OF THE SOCIETY.

1880.

To the Honourable the Commissioner of Agriculture:

SIR,—On this, the closing period of another year in the history of our Society, I have the honour to present you with our Annual Report. The year has been marked by an unusual freedom from any alarming invasion by insect pests, nevertheless the total loss caused by injurious insects to crops of various sorts has been considerable. In this Report is embodied illustrated papers by our members on injurious, beneficial and other insects, of such a character as will, we believe, prove instructive to the general public and increase the interest already felt in the operations of our Society.

Our monthly journal, the *Canadian Entomologist*, continues to be received with favour, both in Europe and America. Its issue has been regular; and the twelfth volume is now nearly completed. During the year our library has been materially increased, and many new illustrations of insects obtained with which to embellish our Journal and Report, and thus render our work of much greater benefit to the general public than it would otherwise be.

The accounts, duly audited, are herewith submitted, also the list of officers for the coming year.

Thanking you for the kindly interest you have always taken in the operations of our Society, and the substantial encouragement given, which has enabled us to carry on our work without embarrassment,

I have the honour to be,
Your obedient servant,
Wm. E. Saunders,
Secretary pro tem.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The annual meeting of the above Society was held, according to announcement, in the city of Hamilton, on the evening of Tuesday, the 28th of September, in the City Hall. A number of those especially interested in Entomology from various parts of the Province were present.

The Report of the Council was read and adopted; also that of the Secretary-Treasurer, which showed a satisfactory state of the finances.

ANNUAL STATEMENT OF THE SECRETARY-TREASURER OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, SEPTEMBER, 1880.

Receipts.

Balance from 1879	$152 62
Members' fees and sale of Entomologist	329 94
Merchandise, pins, cork, etc.	57 01
Advertisements	26 15
Interest	14 56
Government grant	1,000 00
	$1,580 28

Disbursements.

Printing Entomologist	$288 00
Mailing "	19 50
Insurance	10 63
Rent	90 02
Annual vote to editor and secretary	150 00
Sundries, freight, etc.	35 27
Postage	35 16
Expenses of sending collection to Ottawa	12 85
Library	136 75
Paper for Entomologist	72 20
Report expenses	129 75
Engraving	141 44
Expenses of council and delegation to A. A. A. S.	61 00
Merchandise—cork	42 91
Balance	354 80
	$1,580 28

Abraham Puddicombe, } *Auditors.*
Charles Chapman. }

REPORT OF THE COUNCIL.

The close of a decade in the history of our Society, as an incorporated institution, prompts your Council to a retrospective glance over the work accomplished. Ten years ago we were weak and feeble; our numbers were few, and a small eight-paged journal, published irregularly, sufficed to chronicle all our doings. At that time it was with us a constant struggle for existence as a Society, when a few generous hearts contributed liberally of their own private means to sustain a work prompted by public need and designed for public benefit. Through the energy of our members and the kindly aid of, at first the Provincial Agricultural Association and subsequently of the Ontario Government, we were soon enabled to emerge from this struggle and to feel that we were established on a firmer basis, with a great field for labour open before us. In this department our members have laboured heartily, looking for no reward beyond the pleasure which arises from the consciousness of doing a good work.

We may point with justifiable pride to the goodly pile of useful literature published by our Society during this period. Ten Annual Reports have been presented to the Government, which have been printed and widely disseminated as a part of the Report of the Commissioner of Agriculture for the Province of Ontario. These Reports of our Society have been full of matter of great importance to the agriculturist and the fruit-grower, since most of the insect enemies to field crops and fruits have been systematically treated of in them, and the remedies best fitted to control or destroy the pests explained. The Reports have been much sought after and have no doubt accomplished much good.

The *Canadian Entomologist*, the monthly organ of our Society, has now nearly completed its twelfth volume, the last ten of which have averaged about 250 pages octavo, nearly all original matter. In these are recorded the observations of our members on all parts of the continent on insect life in its various forms. The life histories of a large number of species have been given in detail, and a vast amount of other material of much value in promoting the interests and advancing the science of Entomology presented. Our journal is held in high esteem abroad as well as at home, and was for some years the only journal devoted exclusively to Entomology on the continent of America. During the past year the *Entomologist* has contained many very valuable papers; among those especially worthy of mention are the contributions of Mr. W. H. Edwards on the life histories of the butterflies of North America. We are pleased to learn that he is still pursuing his investigations in this department, and that he will continue to give the readers of the *Entomologist* the details of his discoveries.

Recognizing the important work our Society is doing, and with the object of further aiding our endeavours, the Ontario Government have added during the past year to our annual grant the sum of $250, which will enable us to illustrate more freely the articles to be published in our reports and in our journal, and to carry on the ordinary operations of our Society without embarrassment.

Besides the publication of the annual reports which are chiefly written for the general public in a popular style, and the *Canadian Entomologist*, which is a scientific record of work done by the members of the Society, but which also usually contains a paper written expressly for beginners in the study of the science, the Society has had prepared and issued to all its members extensive classified lists of the names of all insects in the different orders of which authentic records of their capture within the Dominion could be found. The value of these lists is very great. They are of the greatest assistance in providing the collector with the proper one, from among the many synonyms which, unluckily, such a large number of our insects possess; besides this they give the proper sequence of the different genera of which the orders are composed, and are thus exceedingly useful in arranging a collection. Moreover, they act as a record by which collectors know what has been done in the way of collecting by their predecessors, and when a new species is found it can at once be recorded; by this means many have been added to our lists.

The branches of our Society at Montreal and London continue to prosper. In Montreal, Messrs. Bowles, Lyman & Couper, have prepared and read some valuable papers on their investigations, and in London much good and useful work has been done.

The Council regret that the office of Secretary-Treasurer was left vacant in the early part of this year, owing to the removal from London of Mr. J. H. Bowman, but since his departure, and at the request of the Council, the work has been performed very efficiently by Mr. W. E. Saunders. We take pleasure in calling attention to the satisfactory condition of our funds, as shown by the statement of the Secretary-Treasurer.

Submitted on behalf of the Council.

W. E. SAUNDERS,
Sec.-Treasurer pro tem.

MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

SEVENTH ANNUAL REPORT OF THE COUNCIL.

At the close of the seventh year of the Society's existence, your Council beg to present their annual report. The retrospect of the year in Entomological matters, is a pleasant one. Nine meetings have been held, the attendance at which has been good, and the intercourse of the members has been both agreeable and instructive. Besides the eight papers, whose titles are hereafter given, many valuable observations on insect life have been recorded in our minutes, which will be of great assistance to us in the future.

Your Council would also notice that during the summer of last year, several enjoyable collecting excursions were participated in by the members, resulting in the discovery of several species of insects hitherto unknown in this locality. On the whole, it is with great pleasure that your Council report the Society to be satisfactorily progressing in the study of our science.

The papers read during the year are as follows :

1. " A description of the male Alypia MacCullochii, Kirby."—By Wm. Couper.
2. " Notes on a species of Cossus taken at Montreal."—By F. B. Caulfield.
3. " The milk plant, its insect parasites, red and black in colour."—By Wm. Couper.
4. " How to preserve specimens of insects."—By G. J. Bowles.
5. " On luminous insects."—By Geo. H. Bowles.
6. " Montreal Hymenoptera."—By Wm. Couper.
7. " Notes on rearing Lepidoptera."—By H. H. Lyman.
8. " Some of the insects that frequent the orchard and garden."—(Rev. F. W. Fyles). Selected by G. J. Bowles.

The study of the Hymenoptera of Montreal has been taken up by Mr. Couper, whose capacity and experience render it certain that the task will be well performed, and result in a great increase in our knowledge of that interesting order. Your Council would recommend the members to follow his example, and, during the coming season, give special attention to other divisions which hitherto we have almost neglected, namely, the Diptera, Orthoptera, Hemiptera and Neuroptera.

The following works have been added to the Society's library during the year :—

" Monograph of the Diptera of North America." Part 3, 4 plates, by H. Loew.

" New species of North America Coleoptera." Part 1, by J. L. Leconte.

"The Coleoptera of Kansas and Eastern New Mexico." 2 plates, J. L. Leconte.

" Synopsis of the Melolonthidae of the United States." J. L. Leconte.

" Catalogue of Coleoptera adjacent to the Boundary Line between the United States and Mexico." 1 plate, J. L. Leconte.

" Revision of the Buprestidae of the United States." 1 plate, J. L. Leconte.

" Report of the Entomological Society of Ontario for 1879."

" Report of the Fruit Growers' Association of Montreal, 1879."

The following were presented by the Royal University of Christiana :—

" On the Mollusca of the Arctic Regions." One large volume and two pamphlets.

" A list of Norwegian Lepidoptera taken in 1876."

The Secretary and Treasurer's cash statement is submitted herewith, and shows the finances to be in a satisfactory condition.

In conclusion, your Council would express the hope that the members will not relax their efforts during the present season, and that the result of the summer's campaign will be even more favourable than that of last year.

The whole respectfully submitted.

GEO. J. BOWLES,
President.

GEO. H. BOWLES,
Secretary.

Montreal, 17th May, 1880.

The President then delivered his annual address, for which he received the thanks of the members present.

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

GENTLEMEN,—The past season has not been very eventful in Ontario in matters relating to insect life. No unusual armies of insect enemies have devastated our crops, and our farmers and fruit-growers, in spite of the few perennial foes, which are always more or less troublesome, have realized a bountiful harvest.

Early in the season cut worms were very numerous in the neighbourhood of London, more abundant than I ever remember seeing them before. They destroyed innumerable cabbage plants and other herbaceous plants and flowers; among the latter, pansies seemed to possess great attraction for them. I saw many fine plants of this flower, of the previous year's growth, eaten close to the ground, both leaves and stalks, and from about the roots of a single plant found in several instances from thirty to fifty of the nearly full-grown larvæ. Fortunately their period of activity does not last long, and before the end of June most of them were quietly sleeping in the chrysalis state.

The question of insectivorous birds, and their influence on the insect world about us, is attracting much attention, and the more the subject is discussed the more evident it becomes that very little indeed is *known* in reference to it; that our ideas as to what should guide us are largely inherited, or otherwise based on sentiment, rather than resting upon well ascertained facts. I am well aware that to plead in favour of the birds is a popular course to follow; but the true student of nature is ever seeking after truth, and whether the facts he discovers are in accord with long cherished opinions and popular fancies, or are directly opposed to them, are questions of little moment. The facts, whatever they may be, are what we want.

Insectivorous birds may be conveniently divided into three classes: First, those which take their food entirely on the wing; second, those which feed partly on the wing and partly from trees and shrubs, and on the ground; and third, those which take no food on the wing, but feed entirely either on the ground or from trees or shrubs. In the first class, besides some rare birds which we do not need to mention here, the following are found common in most parts of our Province: the swallows, *Hirundinidæ;* kingbird, *Tyrannus Carolinensis*; pewee, *Sayornis fuscus*, and nighthawk, *Chordeiles popetue*. The food of these birds consists chiefly of flies, a large proportion of which cannot be said to be either noxious or beneficial; many of them in the earlier stages of their existence live in the water, where they devour decaying vegetation, or feast on the lower and simpler forms of animal and vegetable life. The larvæ of many others are scavengers, devouring decaying or putrescent animal and vegetable matter, and hence well deserve to be classed with beneficial insects. In the same class of friendly species will rank a considerable number of others which are parasitic on the bodies of caterpillars, also the rapacious species which sustain themselves by devouring the weaker and less vigorous of their race. A few rare exceptions, of which the wheat midge and Hessian fly may be noted as examples, are very injurious to field crops, while the mosquito and black fly are universally branded as enemies to the human race. These birds also devour a few butterflies and moths, but these, with few exceptions, are harmless. The question, then, to what extent these purely insectivorous birds are beneficial to the farmer or fruit-grower, reasonably admits of much difference of opinion, for while they do devour a few of our tormentors, they probably destroy a much larger number of beneficial insects, the main bulk of their food, however, consisting of harmless species. Doubtless they serve a purpose in maintaining a proper balance among the insect hosts, and between animal and vegetable life, but that their service in these departments is so all-important as some would urge admits of grave doubt.

The birds of the second division, namely, those which take their food partly on the wing and partly from trees and shrubs, or on the ground, are not entirely insectivorous. The remarks just made in reference to the first class will apply also to this, as far as their food is taken on the wing, but on trees or shrubs, or on the ground, they consume insects of entirely different classes, chiefly beetles and the caterpillars of moths and butterflies. The beetles admit of a similar division to that of the flies already noticed; the larger number are harmless, a large proportion of the remainder are beneficial, and a few are injurious. Most of the caterpillars of moths and butterflies are harmless, feeding in limited numbers on a great diversity of shrubs and trees of little or no economic importance. A few may be said to be beneficial, in consequence of their feeding on troublesome weeds, such as thistles, etc., while a few others are decidedly injurious. Among the common birds in this second class I would mention the yellow warbler or spider bird, *Dendroeca æstiva;* the red start, *Setophaga ruticilla;* the red-eyed, and yellow-throated vireos, *Vireo olivaceus* and *V. flavifrons;* the various species of woodpecker, *Picidæ* and the blue bird, *Siala sialis.*

The birds comprised in the third class are only partially insectivorous. Among the common species are the cat-bird, *Galeoscoptes Carolinensis;* robin, *Turdus migratorius,* and brown thrush, *Harporhynchus rufus;* the sparrows, *Fringillidæ;* the cuckoos, *Coccidæ;* the nuthatch, *Sitta Carolinensis;* chickadee, *Parus atricapillus;* kinglets, *Sylviidæ;* meadow-lark, *Sturnella magna;* Baltimore oriole, *Icterus Baltimore,* and the wren, *Troglodytes ædon.* Besides these there are the blackbirds, *Icteridæ,* which in the spring devour more or less insect food, but feed chiefly on grain and seeds during the remainder of the year. Nearly all birds, excepting the rapacious species, feed their young on such soft food as worms, caterpillars, soft-bodied insects and fruit, and, from the time that young birds are hatched until they acquire the power of flight, a very large quantity of insect food is undoubtedly consumed; but the question of the greatest practical importance to the agriculturist is how far are the birds a help in keeping in check *injurious* insects. With the object of obtaining light on this point, I have, with the help of my son, W. E. Saunders—who has for some years paid special attention to this matter—examined the contents of the stomachs of a large number of birds, and I must frankly confess that the larger the experience gained in this direction the more I have been convinced that but comparatively little help is got from birds in keeping in subjection injurious insects.

When the cut worms were so common with us this spring that any bird with a very little effort might have had its fill of them, the contents of a number of stomachs were examined, especially those of the robin, but not a single specimen of this larva was found in any of them. It has been urged that some birds devour the larvæ of the plum curculio by picking them out of the fallen fruit, but I have failed to find any confirmation of this statement, indeed never found a curculio larva in the stomach of any bird excepting once in that of a robin, who had evidently swallowed it by accident when bolting a whole cherry. As for the robin having any claims upon the sympathies of man for the good he does, I fear that but a very slight case can be made out in his favour. Of fruit he is a thief of the worst kind, stealing early and late, from the time of strawberries until the last grapes are gathered; not content to eat entirely the fruit he attacks, but biting a piece out here and there from the finest specimens, and thus destroying a far greater quantity than would suffice to fill him to his utmost capacity. At the time of writing, flocks of the most pertinacious specimens are destroying the best of my grapes, while alongside is a patch of cabbages almost eaten up with the larvæ of the cabbage butterfly—nice, fat, smooth grubs, easily swallowed, but no such thing will Mr. Robin look at as long as good fruit can be had. His tastes are so expensive that to gratify them is to deprive the fruit-grower of a large portion of his profits, hence the sooner the robin ceases to be protected by legislation the better it will be for all lovers of fruit.

The insect world is composed of myriads of specimens which from their varied structure and habits admit of being classified into families, each distinct and usually easily recognizable to the practiced eye of the Entomologist. A large portion of this innumerable host is appointed to prey upon and devour the other portions, and thus it appears to me, that apart from any consideration of insectivorous birds, the insect world would and does, to a large extent, take care of itself, and when an injurious species increases beyond its normal limits, its natural insect enemies, having an unusual amount of material to work on, soon become sufficiently numerous to reduce the number of the injurious insect to its normal proportions again. As an illustration, take the now common cabbage butterfly, *Pieris rapæ.* This insect was in some way brought from Europe to Quebec a few years ago. From Quebec it has since spread over an immense area extending now from Alabama to the waters of Lake Superior, eastward to the Atlantic, and westward many hundreds of miles, and over all this district it has done immense damage to the cabbage crop. Throughout this area insectivorous birds of all sorts prevail; the butterfly is conspicuous, not very strong in flight, and during the day almost constantly on the wing; the larva feeds in exposed situations, is of that smooth character which birds are said to prefer, and although similar in colour to its food plant, is not difficult to detect. Here, then, is an instance where a comparatively feeble insect, particularly vulnerable to attack, has rapidly spread over a large portion of this continent, with little or no opposition from insectivorous birds. Indeed I have never yet found or known to be found a single example either of the butterfly or its larva in the stomach of any bird. In its native home in Europe it is seldom so very destructive as here, for the reason that a small four-winged fly, *Pteromalus puparum*, an insignificant looking little creature, is a parasite on the larva of this butterfly, and hunts its victims with the greatest assiduity; alighting on their backs and thrusting its slender ovipositor through the skin of the larva, it deposits a number of eggs there, which hatch into tiny grubs, and those feed upon and eventually destroy the caterpillar. By the constant efforts of this little parasite the cabbage butterfly is prevented in Europe from becoming a very serious pest. Fortunately this little friend has also been introduced here from Europe, although in what manner is not known, and is rapidly spreading, following in the wake of its prey, and where the parasite has fairly established itself, this butterfly, with its numerous progeny of green caterpillars, soon dwindles in numbers so materially as shortly to cease to be so grievous an evil. The butterfly spreads faster than its enemy and is usually several years in advance of it, but we may confidently anticipate that sooner or later this small fly will do for us what it has done for Europe—keep this troublesome insect within due limits. Many other similar examples might be given.

Further, the help of friendly parasitic insects is so much more efficient because it is in most instances discriminating. As far as is known, the little parasite referred to attacks only the larva of the cabbage butterfly, and in like manner many other parasitic species are restricted in their operations to a single species, while in other instances they are confined to a genus or a group of similar species. This is not so with insectivorous birds; they in most instances devour alike the useful and the injurious species, and the question may well be raised in many instances whether the good they do is not more than counterbalanced by the number of useful insects they devour. Recent observations on the family of thrushes, by Mr. S. A. Forbes, of Illinois, seem to show that their insect food consists largely of beetles belonging to the *Carabidæ*, a family every member of which is useful, since they, as far as is known, feed both in the larval and beetle states exclusively on other insects.

The field here open is a wide and inviting one, on which I trust some of you will enter. I have but touched upon it; as the results of more extended observations are recorded the opinions here expressed may need modifying. I desire to do justice to the birds.

During the month of August last, it was my privilege to visit the Great Manitoulin Island, also Sault Ste. Marie and the district adjoining. Although prevented by an accident from indulging in free locomotion, still I saw much that interested me. On Manitoulin Island I found many of the species of butterflies common in the more southern portions of Ontario; a few moths were also captured. On the shore of Elizabeth Bay, near the western extremity of the island, a full-grown larva of *Attacus luna* was picked up, and on inquiry I learned that earlier in the season that beautiful moth was quite common in that neighbourhood.

In the department of Economic Entomology some items of interest were gleaned. The pea crop throughout this district is an important one, and I made a diligent search in many fields for indications of the presence of the pea bug, *Bruchus pisi*, but could find no traces of it. Satisfactory evidence was furnished me, in at least two instances, of the sowing of seed brought into the island which was badly infested by this weevil, yet I was assured that neither during the season following nor in subsequent seasons did the crop suffer from this pest. The pea crops growing in these particular localities were also examined by me. Hence it would appear that the climatic or other conditions prevailing in this district are so unfavourable to this destructive pest that it is unable to survive. Should this exemption prove permanent, the cultivation of the pea there will doubtless be rapidly extended, as there will be a large demand at good prices for seed peas from this section, since so many portions of the Province are now so overrun with the pea bug that it is difficult to get seed fit for sowing; and, for the same reason, such seed peas will be readily purchased for planting in the Western States.

For many years the district extending from Goderich to Collingwood has, in consequence of its exemption from curculio, been extremely favourable for plum culture, and here immense quantities have been grown and shipped to other parts of Canada and the United States, Goderich being for many years an important centre for the production and shipment of this fine fruit; but within a brief period this foe has invaded Goderich in such force that to grow plums successfully there, warfare must now be maintained against this pest similar to that practised in the more southern sections of the Province. This enemy has now advanced as far as Southampton, and before many years we may reasonably expect that the favoured district at present exempt, from Owen Sound to Collingwood, will be similarly invaded. Thinking that the Manitoulin Island, from its insulated position, might possibly offer in the future a fine field for this department of fruit industry, I examined carefully, whenever opportunity offered, for evidence of the presence of this insect. In the neighbourhood of Manitowaning I found two trees of Lombard, a blue plum, the name of which I could not ascertain, and two wild plums, all fruiting, but could find no traces of the work of the curculio; but on a farm in about the centre of the island, three miles from Gore Bay, I found on a wild plum tree which was fruiting in the farmer's garden a number of stung plums, and on opening one of them found the larva of the plum curculio nearly full grown. Since wild plums are found in many parts of the island, it is probable that the curculio will be found in other districts there. I saw several wild plum trees at the Sault Ste. Marie, but had no opportunity of examining the fruit satisfactorily; from what I saw I was led to believe that there was no curculio in that region. The cultivation of fruit both on the Manitoulin Island and at the Sault is so entirely in its infancy that it is difficult to form any decided opinion as to the probable future of this department of industry in those districts.

In many sections, forest fires have destroyed a considerable proportion of the original woods, leaving many of the larger trees standing scorched and dead. From these much marketable lumber could be got, were it not for the destructive work of the wood-boring beetles; these troublesome creatures have bored through the trees in every direction, and thus made the timber obtainable from them worthless for market, and useful only in the construction of barns, sheds, etc., on the property of the owners. Both of the large species of long-horned beetles, *Monohammus confusor* and *scutellatus*, appear to be abundant, the latter I think most common; some of the small wood-boring beetles belonging to the family *Scolytidæ* are also very numerous.

The cabbage butterfly, *Pieris rapæ*, has within the last two or three years spread over the whole of the area I visited, and is playing sad havoc with the cabbage crop. In Manitoulin Island I found a specimen or two of the Colorado potato beetle, and made further search among growing potatoes, but could find no more. I was informed that this beetle had been seen occasionally for several years past, but that it had not made any headway in any part of the island. Another insect was found attacking the potato vines, although not injuring them very much. I refer to a species of blistering beetle, *Epicauta* *pennsylvanica*, called here the black bug. In some potato patches it was quite abundant, and the leaves were partially devoured, but nowhere did I see them in sufficient numbers to materially injure the crop. Since the larva of this insect does not feed on the plant, and the insect consumes the potato vine only while in the perfect or beetle state, no serious injury is likely to result from its presence. Its larval habits are such that if abundant one year it is almost sure to be correspondingly scarce the following season.

In the garden of Mr. J. C. Phipps, the Indian Agent of the Government at Manitowaning, I was surprised to find that the oyster-shell bark louse, which injures apple trees, was not only abundant on the apple trees, but the stems of both black and red currant bushes were also thickly clad with them to such an extent as to have killed a number of them. I had never before seen this destructive insect attack the currant, but it has been occasionally observed on currant bushes in the United States.

For several years past I have had occasion to refer to the depredations of the forest tent caterpillar, *Clisiocampa sylvatica*, which has devastated our gardens, orchards and forests; it has now happily almost disappeared, a result brought about, I have no doubt, mainly through the agency of parasitic flies, several species of which have been preying on them extensively. In some sections of the Province the rose-bug, *Macrodactylus subspinosus*, has been abundant and injurious. In East Flamboro' I am informed that they were very destructive to the sweet cherries, devouring the fruit, and that they also injured the grape crop by eating the bunches shortly after blossoming. Some grape growers have also suffered considerably from the attacks of the grape vine flea-beetle, which devours the buds just as they are swelling in the spring.

At the late meeting of the Entomological Club of the American Association for the Advancement of Science, in Boston, our Society was represented by Mr. H. H. Lyman, of Montreal, and the Rev. C. J. S. Bethune, whose able report of the important proceedings of the Club will be read with interest. It is gratifying to learn that the good work done by the Club has given it such a standing that the Association has seen fit to establish it as a permanent Sub-section, and the more important papers read will in future be published in the yearly volume of proceedings.

During the year the New York State Legislature has appointed J. A. Lintner, of Albany, N.Y., as State Entomologist. New York was the first State in the Union to look after the interests of agriculture in this direction and appoint an officer for the special purpose of reporting on noxious insects. The many reports of the late Dr. Fitch, extending over a lengthened period, are well known and much valued; his successor, Mr. Lintner, is a man peculiarly fitted for the position—a most patient and accurate observer, a skilled Entomologist; with an experience in this department of some thirty years, he brings to the task all the necessary qualifications. Seldom has there been an appointment so judiciously made, and I feel sure that great good will result from it.

Since I last addressed you a special Commission has been appointed by the Ontario Government to inquire into the agricultural resources of the country, and the progress and condition of agriculture therein, and recognizing the important and intimate connection of Entomology with agriculture, the Government has seen fit to appoint your presiding officer as one of the Commissioners. In performing the duties devolving upon me in this position I shall endeavour to give to Entomological matters, bearing on agriculture, that prominence which their importance demands.

WM. SAUNDERS.

The election of officers was then proceeded with, which resulted as follows:

President.—Wm. Saunders, London.

Vice-President.—Rev. C. J. S. Bethune, M.A., Port Hope.

Secretary-Treasurer.—E. B. Reed, London.

Librarian.—W. E. Saunders, London.

Council.—J. A. Moffat, Hamilton; James Fletcher, Ottawa; R. V. Rogers, Kingston; G. J. Bowles, Montreal; J. M. Denton, London; W. H. Harrington, Ottawa; and Wm. Couper, Montreal.

Editor.—Wm. Saunders.

Editing Committee.—Rev. C. J. S. Bethune, E. B. Reed, J. M. Denton.

Auditors.—Chas. Chapman, A Puddicombe.

After the routine business was concluded, Mr. Bethune offered some remarks on the moth of the cotton worm, *Aletia argillacea.* Twelve years ago he found it extremely abundant, late in the season, on ripe plums. He had not taken the insect again until this autumn, when they were found to be quite common in his garden. The opinion which had been advanced by Prof. Riley, of Washington, that the examples of the moth taken in these northern sections had flown northward from their breeding places in the south, he did not concur in, but believed that the insect must feed on some malvaceous plant in our midst, since the specimens he had captured were very perfect, and looked as if they had just escaped from the chrysalis. He referred to the fact of this insect having been found common in many of the Northern States, as well as in Canada.

Mr. Reed stated that he had taken this insect also in London.

Mr. Moffatt exhibited a number of interesting insects which had been captured by him at Long Point and at Ridgeway, among others *Papilio cresphontes*, *P. marcellus*, *P. philenor*, *Darapsa versicolor* and *Junonia cœnia.*

Mr. Denton reported the capture of *J. cœnia* and *Libythea Bachmani* at Port Stanley; also of *Thyreus Abbotii* at London.

Mr. Moffatt stated that this beautiful sphinx, *T. Abbotii*, had been comparatively common in Hamilton, and that a number of the larvæ had been reared.

Mr. Fletcher reported having captured two specimens of *Erebus odora* at Ottawa, one of them so perfect that he thought it was impossible that it could have flown for any distance, and thinks it must have bred in the neighbourhood.

Mr. Saunders referred to several other instances of the capture of this rare moth in Canada during the past few years.

Mr. Fletcher referred to the fact that during the last year there were published a number of papers on popular Entomology, and he hoped to see them continued, as he believed they were doing good service in making our valuable monthly journal more popular. Several of the members present promised to prepare papers of this character during the coming year.

Mr. Young, of Hamilton, asked for information on the best manner of preserving caterpillars, and inquired if any of the members had any experience in blowing them.

Mr. Reed stated that he had tried and failed. Mr. Fletcher had the same experience to relate, and had found that the only satisfactory method was to draw and colour them from nature.

Mr. Fletcher thought that most of our collections were deficient in specimens illustrating nature; that while we had spread specimens, we should also have them as at rest, and where possible, the larvæ, chrysalids and eggs.

Mr. Reed asked a question in reference to *Anisota rubicunda*, which he had found common on maple about London, but very hard to rear; he wished to know the experience of other collectors. Several of the members present stated that they also had found it difficult to rear them.

Mr. Young had reared a brood of them from butternut and beech, and found them to prefer beech to any other food. Mr. Bethune had also found them on beech trees.

Mr. Fletcher had found a small fly attacking beans this year; the larva had eaten the stem of the bean and bored into the root, and finally produced a small fly somewhat resembling a house fly.

Mr. Saunders had found several years ago a very similar fly, probably the same species, attacking the stems and roots of young cabbage plants. On comparing the fly with the description given in Curtis' Farm Insects of the root-eating fly, *Anthomyia radicum*, often so troublesome in Europe, he thought it probable that it was the same species. Mr. Saunders also reported the capture of *P. cresphontes* very early in spring, finding the larva nearly full grown in June, which became a chrysalis, and from which the perfect insect escaped in abo uta fortnight. He had also taken the full grown larva late in the fall, which had passed the winter in the chrysalis state, from which facts he drew the inference that this species is double-brooded in Canada.

Mr. Fletcher reported having found the larva of *Ceratomia quadricornis* about Ottawa, and finds it a difficult insect to rear.

Mr. Young had fed a brood of the larva of *Telea polyphemus* on black birch, on which they seemed to thrive remarkably well.

Mr. Kyle, of Dundas, stated that he had found *polyphemus* feeding on witch hazel (*Hamamelis virginica*), and *promethea* feeding on ash and lilac.

Mr. Moffatt had found *promethea* also on wild cherry, as well as on ash, sassafras and lilac.

ANNUAL MEETING OF THE LONDON BRANCH.

The Annual Meeting of the London Branch of the Entomological Society of Ontario was held on Tuesday, the 20th day of January, at eight o'clock in the evening, at the rooms of the Society; the President, Mr. J. M. Denton, in the chair.

Mr. Saunders reported on behalf of the Committee on Rooms, that new rooms could be secured very advantageously, situated in the Victoria Hall Buildings, and recommended that steps be at once taken to secure them. On motion, the report of the Committee was received and adopted.

The Annual Report of the Secretary-Treasurer was read, showing a small balance to the credit of the branch.

The election of officers followed, when the following gentlemen were elected:—

President.—J. M. Denton.
Vice-President.—A. Puddicombe.
Secretary-Treasurer.—W. E. Saunders.
Curator.—C. Chapman.
Council.—Messrs. H. B. Bock, E. B. Reed and W. Saunders.
Auditors.—J. H. Bowman and H. B. Bock.

Mr. Saunders reported the donation of two boxes of *Micro-lepidoptera* for the collection of the Society, by V. T. Chambers, Esq., of Covington, Kentucky; also two magnificent specimens of *Samia gloveri*, by A. H. Mundt, Esq., of Fairbury, Illinois.

The following additions to the library were also reported: from the Department of the Interior, Washington, "Hayden's Report on the Survey of Idaho and Wyoming," and "Prof. Riley's Report on the Silkworm."

W. E. Saunders,
Secretary-Treasurer.

ANNUAL MEETING OF THE MONTREAL BRANCH.

The Seventh Annual General Meeting of the Montreal Branch of the Entomological Society of Ontario was held on Monday, the 17th May, 1880, at the residence of the Vice-President, Mr. H. H. Lyman.

An interesting paper was read by Mr. Couper on the milk-weed (*Asclepias tuberosa*) and some of its insect frequenters. The paper drew attention to the curious fact that the colours of the different insects feeding upon this plant were, almost without exception, red and black.

The Secretary-Treasurer read his Annual Report, which showed the finances to be in a most satisfactory condition.

The election of officers then took place, resulting as follows:—

President.—G. J. Bowles.
Vice-President.—G. B. Pearson.
Secretary-Treasurer.—Geo. H. Bowles.
Curator.—F. B. Caulfield.
Council.—Messrs. H. H. Lyman, Wm. Couper and Robert Jack.

A short time was pleasantly spent in examining several cases of rare *Lepidoptera* belonging to Mr. Lyman, after which the meeting adjourned.

Geo. H. Bowles,
Secretary-Treasurer.

ANNUAL MEETING OF THE ENTOMOLOGICAL CLUB OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The annual gathering of the Entomologists of North America, in connection with the meeting of the A. A. A. S., took place this year at Boston, Mass., and was the most important that has ever been held, both as regards the largeness of the attendance, the number and value of the papers read, and also as regards the general interest taken in the proceedings. So highly indeed was it esteemed that the Standing Committee of the Association formed the Club into a Sub-section of Section B., (Zoology, Botany, etc.), and will publish its proceedings in the annual volume of transactions.

The first session was held in the lecture-room of the Museum of the Boston Society of Natural History, at two o'clock, p.m., on Tuesday, August 24th, 1880; the President, S. H. Scudder, of Cambridge, Mass., in the chair. There were over sixty persons present during this first meeting, and at least one hundred in all must have attended the various sessions of the Club. Among those present were the following Entomologists of note:— Dr. J. A. Lintner, Dr. John L. LeConte, Dr. John G. Morris, Prof. C. V. Riley, Dr. H. A. Hagen, A. R. Grote, Prof. Packard, S. S. Haldeman, B. P. Mann, Prof. C. H. Fernald, Prof. A. J. Cook, Dr. C. S. Minot, Rev. H. C. McCook, E. P. Austin, E. L. Graet, H. F. Bassett, J. D. Putnam, Dr. E. L. Mark, E. Burgess, Dr. Martin, J. G. Henderson, Prof. Morse, Dr. Hoy, O. S. Westcott and J. H. Emerton. The Entomological Society of Ontario was represented by the Rev. C. J. S. Bethune, of Port Hope, and H. H. Lyman, of Montreal.

After the meeting had been called to order, the President, Mr. Scudder, delivered the following address on "Problems in Entomology:"—

ANNUAL ADDRESS OF THE PRESIDENT.

It is the good fortune of your President on this occasion to welcome you to his native heath, where our favourite science has been longer, more uninterruptedly, and, perhaps, more zealously cultivated than anywhere else in the new world. Here, in the last century, Peck studied the cankerworm and the slug-worm of the cherry, and, in late years, *Rhynchaenus*, *Stenocorus*, and *Cossus*—all highly destructive insects. Here lived Harris, who cultivated Entomology in its broadest sense, and whose classic treatise was the first important Government publication on injurious insects. Here, to-day, we have two Associations for our work, consisting, it will be confessed, of nearly the same individuals, and not many of them, but meeting frequently—one in Boston, the other in Cambridge. Harvard acknowledges the claims of our study in supporting not only an instructor in Entomology at its Agricultural School, but a full professor of the same in the University at large.

Harris attributed to Peck his special interest in Entomology, and his first paper, that on the salt-marsh caterpillar, appeared in the *Massachusetts Agricultural Repository* only four years after Peck's last, in the same magazine, on cherry and oak insects. How many of us have drawn our first inspirations from Harris? Yet probably not one of our local Entomologists ever saw him. The general direction of Harris' studies doubtless arose from the predilections of his instructor; and the unprecedented growth of economic Entomology in this country, where it flourishes as nowhere else, must be credited primarily to the influence of Harris' work. With every temptation which the wealth of new material about him could give, or which a very extensive correspondence with naturalists devoting themselves almost exclusively to systematic work, like Say, would naturally foster, he wisely followed the bent given his studies by his early training under Peck, and left a better example and a more generous and enduring influence.

In our own day, the spreading territory of the United States, the penetration of its wilds, and the intersection of its whole area by routes of travel, the wider distribution and greatly increased numbers of local Entomologists, as well as the demand for our natural products abroad, have set also before *us* the same temptation to study only new forms and to cultivate descriptive work, to the neglect of the choicer, broader fields of an ever-opening science. It is this danger to which I venture briefly to call your attention to-day, not by way of disparaging the former, but rather in the hope that some of our younger members, who have not yet fallen into the ruts of work, may be induced to turn their attention to some of the more fruitful fields of diligent research.

We should not apply the term descriptive work merely to the study of the external features of insects. The great bulk of what passes for comparative anatomy, physiology and embryology, is purely descriptive, and is only to be awarded a higher grade in a scale of studies than that which deals with the external properties, when it requires a better training of the hand and eye to carry it out, and greater patience of investigation. We pass at once to a higher grade of research when we deal with comparisons or processes (which, of course, involve comparisons). All good descriptive work, indeed, is also comparative; but at the best it is so only in the narrowest sense, for only intimately allied forms are compared. In descriptive work we deal with simple facts; in comparative work we deal with their collocation. "Facts," said Agassiz, one day, "Facts are stupid things, until brought into connection with some general law."

It is to this higher plane that concerns itself with general laws that I would urge the young student to bend his steps. The way is hard; but in this lies one of its charms, for labour is its own reward. It is by patient plodding that the goal is reached; every step costs and counts; the ever-broadening field of knowledge exhilarates the spirit and intensifies the ambition; there is no such thing as satiety—study of this sort never palls.

It is hardly necessary to point out that so-called systematic work never reaches this higher grade unless it is monographic; unless it deals in a broad way with the relationship and general affinities of insects. It is not my purpose to call attention here to the needs of science in this department, as they are too patent to escape observation; but if one desires a model upon which to construct such work, one need not look further than the "Revision of the Rhynchophora," by Drs. LeConte and Horn. Rather than linger here, we prefer to pass directly to some of the obscurer fields of study.

When we compare the number of insect Embryologists in America with that of their European colleagues, the result is somewhat disheartening and discreditable; although perhaps the comparison would not be quite so disproportionate were some of our students to publish their notes. But take all that has been done upon both sides of the water, and what a meagre showing it makes. Of how many families of *Coleoptera* alone have we the embryonic history of a single species? Of two of the four families of butterflies, the fertile eggs of which are perfectly easy to obtain, nothing is known. In short, one may readily choose numbers of typical groups whose embryonic history would be a great acquisition to science. Here is a broad field. From the special range of my own studies let me recommend to any one eager for this work to choose the eggs of our common copper butterfly, which she will lay to order on sorrel, and the earlier stages of which can be obtained from the parent at two or three different times of the year; or the eggs of any of our common skippers, which deposit on grass, and which are equally easy to obtain, although only once a year. Or, if we turn to *Orthoptera*, the eggs of our common *Oecanthus*, concealed all winter in raspberry twigs, are more transparent and more easily obtained than those of any other cricket; and our knowledge of the embryology of any of the *Gryllidae* is very fragmentary, and of this particular tribe, *nil*. Better still, perhaps, would be the choice of our common walking-stick, as it belongs to a bizarre and isolated type, now known to be of very ancient ancestry, and of whose embryonic history nothing has been published. I have, indeed, a few incomplete notes upon this insect, but they relate wholly to a late period of development, and were made before the time of the microtome, when work over such coarse-shelled eggs was very difficult and unsatisfactory. The eggs may be readily procured, the insect being abundant in scrub-oak fields; the mother drops the eggs loosely on the ground, and from imprisoned specimens I have procured scores in a single season. Any one who will glance over the history of what has been done in insect embryology will be able to select a hundred examples as important and as easy to obtain as those already named, and by concentrating his work upon them will do better service than in an aimless selection of what may come to his hand.

In following the post-embryonal history of insects there is work for all. While allied forms have in general a very similar development, there are so many which are unexpectedly found to differ from one another, that every addition to our knowledge of the life histories of insects is a gain, and they are to be praised who give their close attention to this matter. Here is a field any Entomologist, even the most unskilled, may cultivate to his advantage and with the assurance that every new history he works out is a distinct addition to the science. The importance of an accumulation of facts in this field can hardly be over-estimated, and those whose opportunities for field work are good, should especially take this suggestion to heart. Nor, by any means, is the work confined to the mere collection of facts. How to account for this extraordinary diversity of life and habits among insects, and what its meaning may be, is one of the problems of the evolutionist. There are also here some especially curious inquiries, to which Sir John Lubbock and others have recently called attention, and to which, in this country, Mr. Riley has contributed by his history of *Epicauta* and other *Meloidæ*. I refer to the questions connected with so-called hypermetamorphosis in insects. In these cases there are changes of form during the larval period greater than exist between larva and pupa, or even between larva and imago, in some insects. There are also slighter changes than these which very many larvæ undergo; indeed, it may safely be asserted that the newly-hatched and the mature larvæ of all external feeders differ from each other in some important features. The differences are really great (when compared to the differences between genera of the same family at a similar time of life) in all lepidopterous larvæ, as well as in all *Orthoptera* which have come under my notice. No attempt to co-ordinate these differences, or to study their meanings, or to show the nature of their evident relationship to hypermetamorphosis has ever been attempted.

Not less inviting is the boundless region of investigation into the habits of insects and their relation to their environment. The impulse given to these studies by the rise of Darwinism, and the sudden and curious importance they have assumed in later investigations into the origin and kinship of insects, need only to be mentioned to be acknowledged at once by all of you. The variation in coloration and form exhibited by the same insect at different seasons or in different stations, "sports," the phenomena of dimorphism, and that world of differences between the sexes, bearing no direct relation to sexuality; mimicry also, phosphorescence and its relations to life, the odours of insects, the relation of anthophilous insects to the colours and fructification of flowers, the modes of communication between members of communities, the range and action of the senses,* language, commensalism—these are simply a few topics selected quite at random from hundreds which might be suggested, in each of which new observations and comparative studies are urgently demanded.

The fundamental principles of the morphology of insects were laid down by Savigny in some memorable memoirs more than sixty years ago; the contributions of no single author since that time have added so much to our knowledge, notwithstanding the aid which embryology has been able to bring. Nevertheless there remain many unsolved problems in insect morphology which by their nature are little likely to receive help from this source. Let me mention three:

The first concerns the structure of the organs of flight. The very nomenclature of the veins shows the disgraceful condition of our philosophy of these parts; the same terminology is not employed in any two of the larger sub-orders of insects; names without number have been proposed, rarely, however, by any author with a view to their applicability to any group outside that which formed his special study; and a tabular view which should illustrate them all would be a curious sight. A careful study of the main and subordinate veins, their relations to each other, to the different regions of the wing, to the supporting parts of the thorax and to the alar muscles, should be carried through the entire order of insects; by no means, either, neglecting their development in time, and possibly deriving some assistance in working our homologies by the study of their hypodermic development.

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* Notice Meyer's beautiful studies on the perception of sound by the mosquito.

The second concerns the mouth parts. The general homologies of these organs were clearly and accurately enough stated by Savigny, though one may perhaps have a right to consider the last word not yet said when one recalls Saussure's recent claim to have found in *Hemimerus* a second labium. What I refer to, however, is another point: it relates to appendages of the maxillæ and the labium. Considering the labium as a soldered pair of secondary maxillæ we have at the most, on either pair of maxillæ, three appendages upon either side. These appendages, as you know, are very variously developed in different sub-orders of insects, or even in the same sub-order; and it has at least not been shown, and I question if it can be done, that the parts bearing similar names in different sub-orders are always homologous organs. Here is a study as broad and perhaps as difficult as the last.

The third is the morphological significance of monstrosities, especially of such as are termed monstrosities by excess. The literature of the subject is very scattered, and the material much more extensive than many of you may think. At present this subject is, so to speak, only one of the curiosities of Entomology, but we may be coufident that it will one day show important relations to the story of life.

After all the labours of Herold, Treviranus, Lyonet, Dufour, and dozens of other such industrious and illustrious workers, is there anything important remaining to be done in the gross anatomy of insects? some of you would perhaps ask. Let the recent work of some of our own number answer, which has shown in the *Hemiptera* and *Lepidoptera* the existence of a curious pumping arrangement by which nutritious fluids are forced into the stomach. It is certainly strange that after all that has been said as to the mode in which a butterfly feeds, that no one should have dissected a specimen with sufficient care to have seen the pharyngeal sac which Mr. Burgess will soon show us. No! the field is still an open one, as the annual reviews clearly show. The curious results of Floegel's studies of the brain, the oddly-constructed sense-organs found by Graber and Meyer (earlier noticed briefly by Leydig) in the antennæ of Diptera, the important anatomical distinctions discovered by Forel in different groups of ants, the strange modification of the tip of the spiral tongue in *Ophideres*, which Darwin, Britenbach and Künckel have discussed, and, above all, the extensive investigations of the nervous system in insects generally, which Brandt has recently undertaken, the exquisite memoir of Grenacher on the structure of the compound eye, and the keen researches of Graber in various departments of insect anatomy, show, by what has been accomplished, how many harvests are still unreaped. The microtome, too, has put a new instrument of precision into the hands of the investigator in this field.

We might in the same way point out some of the special needs in the study of the finer anatomy or histology of insects, but the pressure of other duties borbids a further pursuit of the subject. Enough surely has been suggested, even in this hasty sketch, to show that we cannot yet rest upon our oars, but must push forward undaunted into still unknown waters. If these few words shall arouse in any one a higher ambition, leading to better work, their aim will have been accomplished.

On motion of the Secretary, B. P. Mann, the minutes of the last meeting of the Club were adopted as printed in the *Canadian Etomologist.*

The President read portions of a letter from Mr. Wm. Saunders, of London, Ont., explaining his absence owing to a severe accident, and expressed the great regret felt by all present that Mr. Saunders was not with them, and that his absence was occasioned by so unfortunate a cause.

The election of officers then took place (by ballot) with the following result:—

President.—Dr. John G. Morris, of Baltimore, Maryland.
Vice-President.—C. V. Riley, of Washington, D.C.
Secretary.—B. P. Mann, of Cambridge, Mass.

Mr. A. R. Grote, of Buffalo, N.Y., delivered an able and interesting lecture on certain generic characteristics of the *Noctuidæ*, which, it is to be hoped, he will prepare for publication. At the close of his remarks he expressed his anxiety that describers of *Noctuids* should refer particularly to those parts on which generic characters are based.

Prof. A. J. Cook, of the State Agricultural College, Lansing, Mich., gave an account of recent investigations in Apiculture. Among many interesting facts he stated that if the wings of the virgin queen be clipped, or the entrance to the hive be so contracted that she cannot fly forth, or, again, if she be reared where there are no drones, she will not be sterile, but from her eggs only drones will be produced; that the fate of the drones in a hive depends on the prosperity of the colony—with a rapid increase of bees and honey they are safe, but if there is a period of adversity in these respects, unless caused by the loss or sterility of the queen, they are speedily destroyed by the workers; that worker bees are imperfectly developed females; that bees possess and employ the sense of smell, and that they have a good knowledge of locality. In answer to a question from Dr. Morris respecting the alleged robbery of fruit by bees, whether they will not perforate ripe fruits if starved for a time, Prof. Cook replied that he had not tried starvation, but he had placed punctured grapes before bees and found that they would sip the juice with zest, but when he replaced the fruit with sound specimens they did not attempt to touch them.

Mr. Scudder then exhibited some illustrations of rare fossil insects, prepared for publication in Dr. Hayden's report, and a large volume of lithographed plates, coloured drawings, etc., of Diurnal Lepidoptera in all their stages, which he had had made to illustrate his proposed great work on the Butterflies of North America.

Mr. J. D. Putnam, of the Davenport Academy, presented some notes on the North American Galeodes (*Solpugidæ*), and exhibited specimens in illustration.

The Rev. H. C. McCook, of Philadelphia, gave a most interesting lecture on the life history of the honey ants of the Garden of the Gods, Colorado, and illustrated it with specimens of the insects and a great number of very large water-colour drawings. He described fully the chambers excavated by the ants, the insects themselves in all their forms, their nocturnal habits, and their feeding upon the saccharine juice exuded from the galls of the scrub-oak. He stated that the workers are undeveloped females, and that the honey-bearers are a changed form of the worker major with a greatly enlarged crop, in which they store the honey. Mr. McCook has not yet committed his observations to writing, but, we understand, that he will eventually publish them in the proceedings of the Academy of Natural Sciences at Philadelphia. It is impossible to give here even a synopsis of the vast amount of information that he afforded upon this interesting subject.

Prof. Riley remarked, in connection with this subject, that many galls secrete saccharine matter, and that sometimes the gall-insects themselves are entrapped in it; that the ants probably get their honey also from the species of *Coccus* that frequents the scrub-oaks of Colorado; and that almost all species of ants are able to expand their abdomens when necessary.

Dr. Haldeman observed that the reason why hills were constructed by some ants and not by others was probably because some might have the proper materials conveniently at hand and others not. He urged Entomologists to domesticate ants in order to study their habits, most of which are as yet very imperfectly known.

Mr. Bassett stated that very many species of galls are infested by ants; that he has observed a gall on scrub-oak swarming with ants, and with *Cetonia Inda* and other honey-loving insects.

Dr. John L. LeConte, of Philadelphia, Pa., read a paper on a collection of *Coleoptera* obtained from a few hickory twigs. Some hickory trees on a friend's estate, near Philadelphia, were observed to be diseased, and therefore cut down. Some of the twigs were sent to him, and from them he obtained no less than twenty-two species of *Coleoptera*. He expressed a strong hope that some competent Entomologist should prepare a list of the insects that infest forest trees, and that it should be appended to the report about to be issued by the U. S. Commission on Forestry.

Dr. Morris stated that he also had obtained a considerable number of species of beetles from twigs.

Mr. Haldeman said that the hickory was more infested with insects than any other tree.

Dr. LeConte next read a paper on the so-called "Lightning Bugs" (*Lampyridæ*).

Mr. Austin remarked that when a fire-fly is at rest there is a faint ray of light visible, proceeding from the edge of the segments of the abdomen; when the insect is emitting the flashes of light it moves these segments, and so reveals more of the light.

Mr. Martin stated that he had observed a fire-fly in a spider's web, and that it emitted very rapid flashes of light at first, but that they gradually diminished in brilliance till at length they died out.

On motion, the meeting then adjourned till 8 o'clock, p.m.

Tuesday Evening Session.

At 8 o'clock, the Entomological Club met at the Hotel Vendôme, Dr. J. G. Morris in the chair.

Mr. H. F. Bassett, of Waterbury, Conn., gave an account of the "Structure and Development of certain Hymenopterous Galls." He exhibited specimens of galls produced on plants and trees, and spoke of the alternation of two forms belonging to one species. The seminator deposits its eggs in the young acorn, and from the sting or puncture the gall grows, having the appearance of another acorn. This falls to the ground in September, and remains twenty-one months, at the end of which time the gall-flies are produced, which are all females. These females lay their eggs in the buds of the trees in the spring, and from these galls are formed, out of which are developed flies of both sexes. All galls may be divided into two classes:—First, those formed in autumn, which do not develop till the next or a succeeding year, the imagoes or perfect insects hatched from them being always females; and secondly, those formed in the spring, the progeny of which are of both sexes. He considered that the woolly substance that covers these galls is an excessive development of the pubescence of the leaf, and thought that the growth of the galls is produced by the action of the poison that is infused by the parent insect when making the sting or puncture, because he often could find in a gall no trace of any larva.

Prof. Riley expressed his opinion that galls are formed both by the poison injected with the egg, and by the irritant action of the larva. He spoke also of the sweet exudation on galls, and remarked that honey-dew is in some cases the natural exudation of the plant, independent of the action of insects upon it.

Prof. C. H. Fernald, of Orono, Me., exhibited three volumes recently published by Lord Walsingham, on "North American Micro-Lepidoptera, Tortricidæ," illustrated with coloured plates, and forming part of the British Museum Catalogues for 1879; also, by the same author, a volume on the "New and little-known Species of North American Tineidæ," and another on "The Pterophoridæ of California and Oregon." He then proceeded to read a paper on the Classification of *Tortricidæ*, illustrating his remarks by some wings prepared for the microscope. These slides, which beautifully exhibited the venation of the wings, were mounted with glycerine boiled gently over the lamp; the wings were bleached by Dimmock's process.

Dr. H. A. Hagen, of the Museum of Comparative Zoology, Cambridge, Mass., read a paper on the importation of the Hessian fly. The generally accepted theory, from which the insect derives its common name, is that the insect was brought from Europe to America, about a century ago, in the straw used for bedding by the Hessian troops employed by the British Government in the war of the Revolution. This theory Dr. Hagen rejects, and in a sketch of the history of the movement of these troops, he showed that the lapse of time during their transportation was considerably greater than that of the term of the normal development of the fly from the egg. He stated that there was some evidence of the existence of the fly in America before the arrival of the Hessian troops, and that it was unknown in Central Europe till recently; there was, however, some evidence that it may have appeared in certain places on the Mediterranean coast at an earlier period. He even thought it possible that the fly might have been imported *from* America into the Mediterranean region of Europe by American trading vessels. His conclusions, as stated in a long and very interesting paper, in which he quoted many German and British official records, may be summed up briefly as follows: 1. It is impossible that the fly could have been imported by Hessian Troops, as proved by the historical records. 2. The fly must have been in America long before the arrival of the Hessian troops. 3. The fly was not known in Germany before 1857, and is probably an indigenous American insect.

Prof. Riley stated that he had so often noticed a retardation of development in insects, that he should not be surprised if this had been the case with the Hessian fly, when imported. Again, that the "flax-seed state" of this insect lasts so long that it might have crossed the Atlantic during that phase of its existence.

Dr. Hagen replied that Dr. Asa Fitch had already proved the impossibility of this.

Prof. Riley accepted the theory that the fly is indigenous to America, and Dr. Hagen stated that he believed that it is indigenous to both Europe and America.

The meeting then adjourned.

Wednesday Afternoon Session.

The Club met for an hour, at 5 o'clock, p.m., in one of the rooms of the Massachusetts Institute of Technology, a large and commodious building, which was almost entirely given up to the work of the Association.

The short time at the disposal of the Club was occupied by the continuation of the Rev. H. C. McCooks lecture on the Honey-ants of the Garden of the Gods, Colorado; the first portion of which he delivered on the previous afternoon. At its conclusion, some remarks were made by Prof. Cook and others, on birds *versus* insects.

Thursday was devoted by the the Association to a visit to Cambridge. Many of the Entomologists took the opportunity of visiting the rooms of the Cambridge Entomological Club, where they were received by Mr. B. P. Mann, the Secretary.

Friday Afternoon Session.

The Club met in their room in the Institute of Technology at 4 o'clock p.m., Mr. A. R. Grote, Vice-president, in the chair.

Dr. LeConte moved that, owing to a resolution passed at the general session of the Association that morning, the Entomological Club do now organize as a permanent Sub-section of the Association. He proceeded to congratulate the Club on the honour thus conferred upon it. It was due to the importance of the subject and the large attendance of Entomologists, no less than to the number of interesting papers offered for their discussion. The resolution was unanimously adopted, and the Club at once organized as a Sub-section with the officers elected on the first day of meeting.

Mr. E. Burgess, of Boston, gave an account of the structure of the mouth organs of Butterflies, describing especially and illustrating with diagrams on the black-board, the proboscis, etc., of the *Archippus*. Remarks were made upon the paper by Dr. Hagen and Messrs. Mann, Cook and Riley.

Dr. Hagen read a paper on the anatomy of *Prodoxus decipiens*, in which he confirmed Mr. Riley's statements.

Prof. Fernald read a paper on *Phoxopteris angulifasciana*, a small tortrix feeding upon clover.

Mr. O. S. Wescott, of Racine, Wis., gave by request an account of a moth trap for collecting insects by light, which he had employed with much success. Dr. Hoy and Mr. Mann also described insect traps that they had found useful.

Mr. Westcott gave an account of the mode of building its web by a geometrical spider, and stated that the insect when forming the concentric lines across the rays measured the distance from the next parallel line by means of its second right fore-leg before attaching the thread to the ray.

Prof. Cook, in answer to a question, stated that he had found a mixture of honey and beer equally efficacious with the ordinary mixture for sugaring.

Mr. Grote remarked that he had found the Colorado potato beetle feeding upon a large cultivated variety of Datura, and feared that it would probably soon prove a serious enemy to the tobacco plant, another member of the family *Solanaceæ*.

Prof. Riley stated that he had found the Colorado beetle in South Carolina.

The meeting adjourned at 6 o'clock.

Monday, August 30th.

The Sub-section of Entomology met at the Institute this morning, Dr. J. G. Morris in the chair. For the first time the titles of the papers to be read, with the names of the officers, were published in the Association programme for the day.

Prof. Fernald gave a brief description of his method of preparing and mounting the wings of *Micro-lepidoptera.*

Mr. B. P. Mann gave an account of the contributions of the Cambridge Entomological Club and the progress of Entomology.

Prof. C. V. Riley described the life-habits of several bee-flies (*Bombyliidæ*), and made some remarks on tree-crickets and on the early stages of *Blepharocera.*

Dr. Hagen exhibited a specimen of *Passalus cornutus*, which was entirely destitute of any trace of elytra, but possessed wings and all other parts quite perfect. He stated that it was impossible that the elytra had been artificially removed and that he considered this to be a very rare natural deformity.

Rev. C. J. S. Bethune, in the absence of Dr. Hoy, who was to have read the next paper on the occurrence of *Aletia argillacea* in Wisconsin, stated that he had learned in conversation with Dr. Hoy that this moth had occurred in immense numbers on ripe melons near Racine, Wis., and that he had himself in the autumn of 1865, taken a great quantity of the moths feeding on fallen plums and apples, but that ordinarily the moth was not at all common in Ontario.

Prof. Riley considered that the *Aletia* flew to the north when superabundant in its natural home in the cotton growing regions of the south; that it fed there on some malvaceous plant, lived a year, but not probably longer, and then was no longer to be found in northern localities until another emigration took place when it again became numerous. He did not think that it could possibly live for more than a few generations in the Nothern States or Canada.

Mr. Mann was of opinion that it must live for years in the north, finding some suitable food plant, though like very many other insects it was frequently scarce and then suddenly appeared in great numbers.

Dr. Lintner stated that he had found the moth at an altitude of 1800 feet on the Adirondack Mountains, and that Dr. Hoy had informed him that he had taken the larva in June at Racine.

Dr. E. L. Mark described some points in the anatomy of the *Coccidæ.*

The list of papers having been exhausted, the Section now adjourned to meet next year in Cincinnati, Ohio.

POPULAR PAPERS ON ENTOMOLOGY.

Entomology for Beginners.

By James Fletcher, Ottawa, Ont.

Entomology seems to be gradually throwing off the veil of contempt under which it has been so long hidden. The Botanist has always to a certain extent been deemed a philosopher from the important part plants play in Pharmacy; the Geologist and Mineralogist, too, from the possibility of their discovering precious metals have been treated by the outside unscientific world as sages worthy of some respect. Entomologists, however, have not thus been honoured by the masses. The question would be asked—What tangible results can come from collecting flies and bugs and sticking pins through them? and in vain the amount of damage done by insects year by year might be estimated and pointed out. This state of affairs, though, I believe, is now at an end. The claims of the science on all agriculturists and horticulturists are daily becoming more apparent. The institution of the United States Entomological Commission, and the success that has attended that organization from the happy choice of such men as Messrs. C. V. Riley and A. S. Packard as directors, has perhaps done more than anything else to open people's eyes to the fact that after all there is something in Entomology. In Canada, too, much good work has been done. In 1868 two Entomological magazines were started, our own important organ, the Canadian Entomologist—in August, for Ontario; and *Le Naturalist Canadien*, edited by the Abbé Provancher, in December, for Quebec; to these is chiefly due the progress the science has made in Canada. The editors of the Canadian Entomologist—Rev. C. J. S. Bethune (1868-1873), and since that time our present esteemed editor—have always by their many charming and descriptive papers evinced a desire to make the study of Entomology as fascinating and easy as possible for beginners, while at the same time they have paid full respect to their scientific readers. *Le Naturalist Canadien* is published in the French language. It was commenced in December, 1868, from which time the Abbé Provancher has fought bravely, and almost single-handed, against all obstacles, striving by its means to create among the French Canadians a love for the natural sciences, particularly Entomology. I am very sorry to see by the December number, that on account of the grant which the Editor received from the Government having been discontinued, his valuable work may possibly be stopped: this would be a great pity, and every Entomologist ought to give a hand in helping him out of his difficulty. The magazine has been of great value to the farmers of Lower Canada, who in its pages have always received courteous answers on any subjects in the many branches of natural history affecting agriculture.

In the eleven volumes of the Entomologist now published, or in the Annual Reports of the Society, descriptions of nearly all the common Canadian insects, and illustrations of many of them, will be found. I would particularly call attention to a paper in the Annual Report of 1872 by Rev. C. J. S. Bethune, entitled "Beneficial Insects." This gives an outline sketch in a concise manner of the different divisions into which insects are divided and the distinguishing points of each.

With the above mentioned volumes and Dr. Packard's Guide to the study of insects, a very complete knowledge of the rudiments of entomology can be obtained; the rest can only be learned by observation and experience in the field. Undoubtedly the first and most important step of all is to commence a collection. Study can only be carried on satisfactorily from the actual specimens, which should be examined alive whenever possible, and full notes taken of any striking peculiarities observed; when preparing specimens for the cabinet, the one idea which has to be born in mind, and upon which the whole value and beauty of the collection depends, is that they may appear natural, and a knowledge of how to effect this can only be attained by observing living specimens.

The Calosomas or Caterpillar-Hunters.

These insects belong to the family called *Carabidæ*, which is a large and difficult family to study, or even to define and limit exactly. The insects belonging to it are remarkable for their graceful forms, and at the same time for their cruel and predacious habits, both in the larval and perfect states. It is this last trait which makes them such useful auxiliaries to the horticulturist.

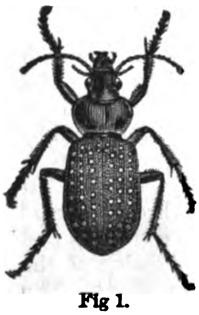

Fig 1.

The better known of the two represented here is called *Calosoma calidum*, Fabr., (fig. 1) or "The Glowing Beautiful-bodied Caterpillar-hunter." As an exception to the general rule, its English name is more formidable than the Latin; but so important a personage is its bearer that I will not deprive him of a single letter of his title, and indeed am almost tempted to add to it the words "most useful." It well merits its appellation, *Calosoma* (*Kalos*—beautiful, and *Soma*—a body). Fig. 1 gives a life size representation of it. The colour of the polished elytra or wing-covers is a deep blue-black, and the six rows of dots with which they are adorned are of a fiery burnished red, for which reason it has been called by the specific name of *calidum*. The legs in our figure are two thick and clumsy, but it must be well known to everyone. It may generally be found in early summer, in damp pastures, either hidden under stones or running in the grass in search of caterpillars and other soft-bodied insects. Jaeger, who first called the members of this genus caterpillar-hunters, says "they may be found every morning and evening upon the branches of trees, looking out for caterpillars and devouring them." They do not, however, restrict themselves to caterpillars, for they will attack and devour a perfect June-bug when fresh from the pupa state and soft, with apparently the same relish as their special dainty, a fat cut-worm. In the larval state they are equally rapacious; they lurk in holes in the ground or under sticks and stones in the daytime, and only leave their retreats as night draws on to go in search of prey. Every spring I have several of these useful and luckily common beetles brought to me by kind friends who have found them in their gardens. To the inquiry "Is this of any use to you?" I have always the answer ready, which somewhat surprises them: "No, but it is of particular use to you; take it carefully back and put it in your garden again; it is the best friend you have there, for it feeds entirely upon your enemies, the wire-worms, cut-worms and white-worms."

I am sure that through the agency of this beetle alone I have been able to gain more respect for the science of Entomology among horticulturists than from all the rest put together.

Much resembling this beetle in shape, but of a very much more striking appearance, is its near relative, *Calosoma scrutator*, Fabr., the "beautiful-bodied searcher," fig. 2. The colour of its wing-covers is bright metallic green, garnished with longitudinal lines and sparcely punctured; round the margin runs an effective line of coppery-red. The head, thorax and legs are almost black; the margin of the thorax having a greenish tinge. The under side is of a deep burnished blue-green hue. Its habits are the same as those of *C. calidum*, but it is a much rarer insect. I have never seen a live specimen; but they are occasionally found in Ontario, and dead specimens are said to be frequently washed up on the outer shore of Toronto Island after a southerly gale.

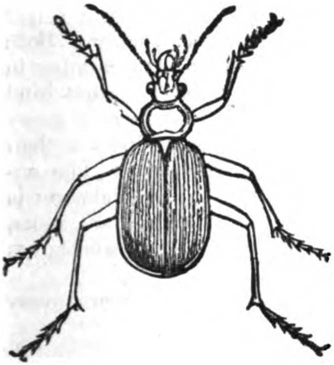

Fig. 2.

THE COMMON WOOLLY BEAR (*Spilosoma virginica*).

By W. Saunders, London, Ont.

The caterpillars known under the common name of "woolly bears" belong to the family of Arctians, and most of the species in the moth state are very pretty objects. The commonest of all the species is *Spilosoma virginica*, a pure white moth which appears on the wing in May, when it deposits its clusters of round yellow eggs on the under side of the leaves of many plants. In a few days these hatch into minute hairy caterpillars, which for a time feed in company, and devour at first the under side of the leaf only, so that it assumes a scorched and withered aspect. In a short time, however, they part company, each one choosing his own course, and blessed with good digestive powers, they eat freely of all parts of the leaf. The full grown caterpillar (fig. 3, *a*) is nearly two inches long, thickly clothed

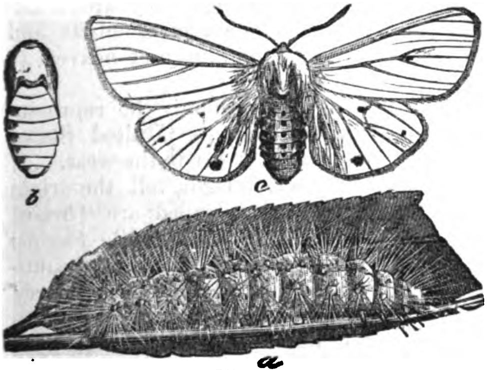

Fig. 3.

with hair usually of a yellowish colour, but not always so, for some are light brown and others a darker brown. The head and feet are usually yellow, and the hairs arise in little tufts from small yellow tubercles arranged nearly in rows across the body. In the spaces between the segments there are darker lines, sometimes brown or dark brown, and occasionally nearly black; there is a dark line along each side, and the under surface is also of a dark shade.

When full grown the caterpillar seeks some sheltered nook in which to change to a chrysalis, attached to the under side of a board, under the bark of a tree or in some crevice in a fence, wherever it is dry and secluded. Having fixed on a suitable locality, the larva proceeds to divest its body of the covering of hairs, and with these woven together with silken threads, it constructs the slight cocoon which is to shelter the chrysalis, and here in a short time the change takes place. From the chrysalis (*b*, fig. 3), which is of the usual brown colour, in a week or two the perfect moth appears, soon to deposit fresh patches of eggs, from which in a few days the second brood of larvæ are hatched, which attain maturity and enter the chrysalis state before winter comes, and remain in this quiescent condition until the following spring.

The moth (fig. 3, *c*) measures when its wings are expanded from one inch and a half to two inches. The figure represents a female; the males are somewhat smaller. Both sexes have the wings snowy white with a few black dots which vary much in number in different specimens; in some there are two on each front wing and three on each hind wing, as in the figure, while in others the spots are almost wanting, and there is every gradation between these extremes. On the under side the spots are more distinct than on the upper, and sometimes the white surface is slightly tinged with yellow. The antennæ are white above, dark brown below, the head and thorax white. The abdomen is orange coloured, sometimes streaked across with white, and has three rows of black spots, one above and one on each side; the under side of the abdomen is white, sometimes tinged with orange.

This species is attacked by several parasites, which destroy immense numbers every year; were it not for this we should soon be overrun with them.

TIGER BEETLES.

By R. V. Rogers, Jr., Kingston, Ont.

There are probably over ninety thousand different species of Beetles in the world, and first and foremost of this mighty legion stand the Cicindelidæ. Well, therefore, might they demand our attention from their high position in the Coleopterous world alone, but they have many other claims on our consideration. They are cosmopolitan—no pent-up Ithaca contracts their powers; they are beautiful; they are fierce; they are bloodthirsty; they are useful; and the family name is an old one—known to scientists and men of letters in the days when Jupiter and Juno were king and queen of heaven, to the inhabitants of old Rome.

The family is divided into several branches; in Canada we have only the representatives of one branch, but it is the original one, the Cicindelas. In the United States there are a couple of other branches as well, which reside principally far to the west.

There is much in a name. The patronymics Smith, Barber, Wright, tell the origin of the family at once; so *Cicindela* informs us that those that are so called are "bright and shining ones," while the English cognomen of tiger beetle lets all Anglo Saxons know that it is a creature that lives by preying on the blood of others. Brilliant, beautiful and elegant in shape are these beetles, and they appear to revel in the merry, merry sunshine; on every bright summer day they are to be found running and flying about sunny banks, sandy places, and wherever the god of day beats down his life-giving rays; most of them avoid vegetation, as it would check their rapid progress; some species, however linger in grassy spots among scattered trees. They are among the most predaceous of the Coleoptera; "they act like the tigers among mammalia, the hawks among birds, the crocodiles among reptiles, or the sharks among fishes." In some of them activity, as well as brilliancy of colouring, is carried to the greatest perfection. In the tropics some few genera are found which alight only on the leaves of trees, but further north they are all terrestrial. The species are more numerous in the temperate and sub-tropical regions, and gradually disappear from view as we journey towards the north pole, until in the latitude of Manitoba (as we are told) but two or three are to be found.

Let us take our *instrumenta belli* and go in quest of some of the dozen species we have in Canada (in North America there are about one hundred). Let us hurry before yonder cloud obscures the sun, for then—like chickens in an eclipse—they will retire to their homes. Here is a likely spot, and there are some specimens of our commonest species *(C. vulgaris)*. Go for that one! He sees us as quickly as as we spy him, and is off, flying rapidly for a few yards and then coming suddenly to the ground with his head towards the enemy. Again and again we start him; at length he tires of the chase and takes a longer flight than usual; we know his little plan, and hurry back to where we first saw him in time to see him alight all unsuspectingly, and we easily take him captive in our toils. Let us examine him. He savagely moves his mandibles and tries to pinch, but his bite is inoffensive and not very painful. Some of them give forth a rather strong scent. This one is a little over an inch long, but barely a quarter of one broad; his head is very large, for he has brains; his jaws are very strong, for he has an appetite, and long and curved—a couple of scimitars, in fact, by which he cuts and carves the quivering carcasses of his prey. His eleven-jointed antennæ are graceful, long and slender. 'Tis true that his back is of rather a dull purple colour, but beneath he is resplendent in a beautiful bright brassy green. Each wing cover is adorned with three whitish irregular stripes. His legs are long and slender, just the things on which to hunt the active insects which he feeds upon.

Michelet speaks of the beauty of one of the next of kin of the captive in our fingers thus glowingly: "The rich and living aliment of the unfortunate insect victim apparently communicates to the Cicindela its glowing colours. Its entire body is embellished with them; on the wings a changeful besprinkling of peacock's eyes; on the fore parts numerous meanders, diversely and softly shaded, are trailed over a dark ground. Abdomen and legs are glazed with such rich hues that no enamel can sustain a comparison with them; the eye can scarcely endure their vivacity. The singular thing is, that besides these enamels you find the dead tones of flowers and the butterfly's wing. To all these various elements add some singularities, which you would suppose to be the work of human art, in the Oriental styles, Persian and Turkish, or as in the Indian shawl, where the colours, slightly subdued, have found an admirable basis, time having gradually lent a grave tone to their sweet harmony."

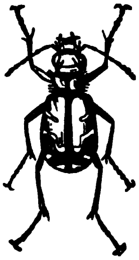
Fig. 4.

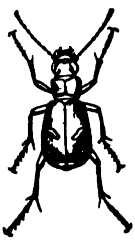
Fig. 5.

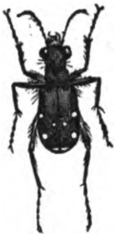
Fig. 6.

When we have let go our common Cicindela, *Cicindela vulgaris* (fig. 4), let us look at the pictures of his—not sisters—but of his cousins and his aunts.

The purple tiger beetle *(C. purpurea* Riv.) is figured as No. 5. It is nearly the same size as *vulgaris*, and is often to be found in its company. Its general colour is a beautiful metallic purple; sometimes, however, it assumes a greenish garb. On either wing cover there is a bent reddish line extended from the outer almost to the inner margin, a dot lower down and another at the extreme tip of the inner margin. It rather delights in chilly weather, and often appears before the snow is well gone. Mr. Bethune says (Rep. Ent. Soc., 1873) that he has caught it in numbers in April, and on one occasion as early as the 17th March, before the snow was gone.

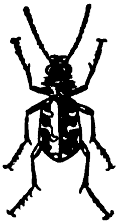
Fig. 7.

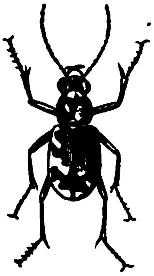
Fig. 8.

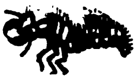
Fig. 9.

The six-spotted tiger beetle (*C. sex-guttata*, Fabr.), fig. 6, is a most beautiful insect of a most brilliant metallic green, flecked with three small white spots on each wing cover; Packard calls these markings "golden dots."

The hairy-necked tiger beetle (*C. hirticollis*, Say), fig. 7, is a common species closely resembling, though smaller than, *C. vulgaris;* it is distinguishable by having whitish hairs on its neck.

C. generosa, Dej., (fig. 8), is more strongly marked than the species already mentioned, and is considerably larger.

C. 12-guttata, Dej., is smaller than *vulgaris*, brownish, and decorated with twelve smaller reddish spots.

C. punctulata, Fab., is about the size of *C. 12-guttata*, and has a row of smaller dots along the inner margin of the wing covers, and a couple of irregular lines on each wing cover.

The tiger beetle may well be called a beneficial insect, and is a valuable and should be a valued friend of man, although some of the species living at the sea-shore feed upon small shrimps, to the loss of humanity. Although it does not, like that brilliant murderess, the Dragon-fly (to quote again the gushing Michelet) clear the atmosphere of the gnats and flies that torment mankind, still with its crossed daggers, which serve it for jaws, it accomplishes a swift and almost incredible havoc among the smaller insects. We should take care of it and respect it. It is an efficacious auxiliary to the agriculturist. The farmer by killing tiger beetles becomes the friend of those insect hosts that fatten on his labours—the preserver and protector of those little enemies which devour his substance. The ferocity of these insects is remarkable. They quickly tear off the wings and legs of their victim, and suck out the contents of its abdomen. Often, when they are disturbed in this agreeable occupation, not wishing to leave it, they fly away with their prey; but they cannot carry a heavy burden to any great distance.

They are true children of earth. The eggs are laid in the earth, and in the earth the grubs are hatched, and in the earth they spend their days, and in the earth they prepare their shrouds, and enwrapped therein sleep their pupa sleep through the long winter, and with the returning warmth of spring crawl out of their earthy chambers to run and sport on earth, seldom using their new found wings to fly away from their beloved mother.

The grubs are curious creatures—hideous hunchbacks (fig. 9), but possessed of brain and stomach. They live in the same localities as their parents, the anxious mother having wisely deposited her eggs where food will be most easily attainable by the larvæ. Let us examine a grub. LeConte says we can easily procure one in spring by placing a fine straw down one of their holes, for the grub will push it out, and rising above ground in his efforts may be captured. Here is a hole, and down goes a straw. Master Cicindela does not like vegetables, and so seeks to reject it with his broad head; when he shows himself we quickly seize him. A perfect Daniel Quilp we find him, with head enormous, flat, metallic colour, armed with long curved jaws. The legs are six in number, and on the back, half way between the legs and tail, "are two curious tubercles, each terminating in a pair of recurved hooks." The head and first division of the body are horny, the rest of the creature is soft. "The larva has all the desire for slaughter evinced by its parents, but its delicate skin, long body and short legs, not only prevent it from chasing prey, but from attempting a struggle with an insect of any size; nevertheless this imperfectly armed creature manages to obtain its food without exposing itself to much risk. With its short, thick, spiny legs it loosens the earth, and then using its flat head as a shovel, and turning itself into a Z, hoists up the clay and upsets it around the mouth of its intended hole. With head and legs, perseverance and time, it sinks a shaft as large in diameter as a lead pencil, and about a foot in depth. (Dr. Duncan says that in England *C. campestris* runs a horizontal gallery as well.) The loose earth around the opening gives way on the approach of any insect and precipitates it into the jaws of the Cicindela, which then descends into its cavern and there at its leisure devours its food." The insect crawls in its tunnel with ease, and if it wishes to remain set fast it sticks the back of its body against the sides and rests safely with the aid of its hooks. In this position it can poke its head out of the ground, thus closing the entrance of its tunnel and awaiting until some ant or other insect passes over. The top of the larva's head forms the floor of the cavity, and when an insect touches it the larva descends at once and with great precipitation, and thus the victim falls into the hole. When fully grown the larva closes up the mouth of its abode, and in quiet and solitude undergoes its metamorphosis, lying dormant during the winter months.

THE TOMATO WORM (*Sphinx quinque-maculata*, Haworth.)

By the Rev. C. J. S. Bethune, Port Hope, Ont.

Almost everyone, I imagine, has had at some time or other his wonder and curiosity excited by the strange-looking pupa of the tomato worm, as it is familiarly termed. It is frequently discovered when digging potatoes in the autumn, or disturbing the soil where tomatoes have been grown. This singular object, which is very correctly represented in the figure, is about two and a half inches long and half an inch in diameter, of a chestnut brown colour, and round in shape, tapering towards both ends; from one end, which is the head of the specimen, there proceeds a long curved proboscis like the handle of a jug; the other end is divided into broad rings, and terminates in a point. To one who had never seen anything of the kind before, this object must at first prove a great puzzle; but a little careful examination will remove some of the mystery. It must be alive, for the tail end moves; but it cannot walk or crawl, and is quite helpless. If we examine it more closely, we find that the rings that move when the creature is touched are very like the rings of a large caterpillar, while at the other end we can trace the eyes, antennæ, and even the short wings of a moth, but all enclosed in a hard brown shell. These things show us that it is an insect in its helpless pupa state; the long jug-handle is the case which contains its tongue for sucking out the nectar from flowers. If we keep it in some damp earth till the next year, there will emerge from it a large handsome moth, of an ashen-grey colour, relieved by five bright orange-yellow spots on each side of its body; its wings expand fully five inches in length, and its body is about the same length as the pupa or chrysalis; its tongue is of immense length, about double that of the body—when at rest it is coiled up like a watch-spring beneath the head of the insect. The name of the creature is the five-spotted sphinx [*Sphinx (Macrosila) quinque-maculata*, Haworth].

The larva or caterpillar of this insect, when fully grown, is larger than it is shown in the figure, being as thick as a man's little finger, and over three inches in length. It feeds on the leaves of both the tomato and potato plants. It varies so much in colour that people often suppose that a number of different species of "worms" are attacking their plants. It is frequently of a bright green marked with white, and having along each side a series of seven oblique greenish-yellow stripes; again it may be found with its general colour dark green, dark brown, blackish green, and other shades, even to deep black. On the last segment of the body there is a curved horn or tail. The accompanying wood-cut (fig. 10) affords so satisfactory a representation of the three stages of the insect that it is unnecessary to enter into a minute detailed description.

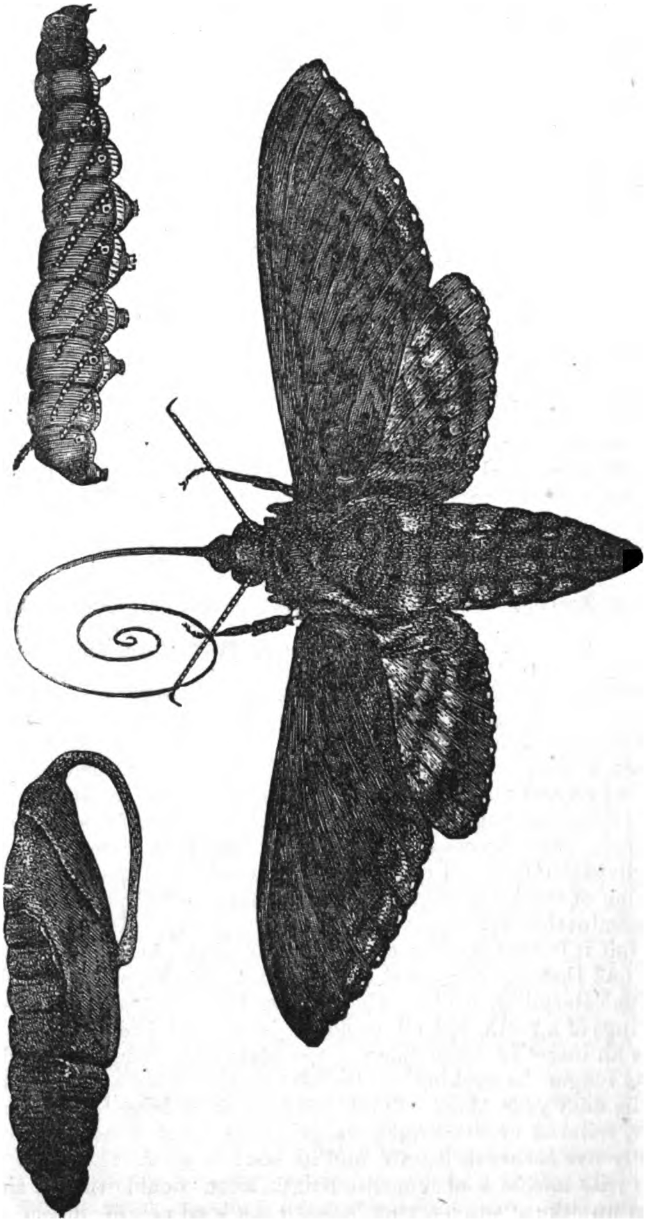

Fig. 10.

The larva is found feeding during July and August. It often so closely resembles the foliage on which it reposes, the bands on its sides mimicking the ribs of the leaves, that it cannot always be detected; its presence, however, may usually be traced by the singularly marked cylindrical pellets of excrement on the ground, and the stripped leaf-stalks of the plant. When fully grown the larva descends into the earth, and there makes a chamber for itself in which to change to its pupa state. Fortunately the insect is not a very common one, its numbers being kept in check by a small ichneumon-fly; otherwise from its size and voracity it would prove most destructive. Very rarely are more than a few specimens seen in a tomato or potato patch. In the summer of 1878, however, as I recorded in the CANADIAN ENTOMOLOGIST (vol. x., p. 218), it was so abundant that a market-gardener who lives near me gathered four bushels of the caterpillars off an acre and a quarter of tomatoes in one day! That year some of the insects attained to the moth or imago state in October, but generally the pupa remains quiescent in the ground till the following season, and the moth appears in June or July. I have now in my possession a living chrysalis of this insect that belonged to the abundant brood of 1878. It was given to me by Mr. David Smart, of Port Hope, who found it, with a large number of others, in his garden. He kept the chrysalids in a box of earth in his cellar all last year; no doubt the coolness prevented the development of the imago. He and I are now both watching with much interest for the appearance of the moths from our specimens, as two years in the pupa state is by no means a common occurrence. That the pupæ are still alive is shown by the readiness with which they move the segments of the abdomen when handled or disturbed.* Notwithstanding the extraordinary abundance of the larvæ in 1878, there were but few to be seen last year in this neighbourhood.

An account of the "tomato worm" will hardly be complete without some reference to the supposed poisonous character of the larva. Some ten years ago, when in charge of the Entomological department of the *Canada Farmer*, I took the trouble to trace up some of the stories then very common in the newspapers about cases of poisoning and death from the effects of the bite or sting or venomous spittle of this insect! The result of my inquiries in many instances proved to be exceedingly amusing. In every case I found that no one could give any information whatever as to even the name of the person who was supposed to have died from the effects of this insect, nor could I obtain a single authentic instance of injury from it. This was, of course, what was to be expected, as the caterpillar is physically incapable of injuring anyone with its bite—much less with its tail or horn, or imaginary sting. In all probability these stories have originated in the fact that persons have been severely affected by getting some of the juices of the tomato plant into an open cut or sore, and then ignorantly have attributed their trouble to the venom of the ugly but innocent caterpillar.

MIGRATORY INSECTS.

By G. J. Bowles, Montreal, P.Q.

The migratory instinct, common to so many species of birds, and even of mammalia, is also exhibited by many species of insects. In the case of birds and animals it has mostly to do with variations of climate, or the necessity of suitably providing for the raising of their young; in the case of insects the causes of migrations are not so evident, and observation is required in order to decide the point, if, indeed, it can be decided at all. The subject is still in obscurity, though the efforts of American Entomologists have thrown a little light upon it with regard to some species. And it is of great interest, not only to Entomologists, but also to tillers of the soil, as some of the insects which exhibit this migratory instinct are among the most injurious to the crops of the farmer and fruit grower.

THE LOCUST.

Chief among the migratory insects stands the locust, considered as a group. On each of the continents, both of the old and new worlds, some species of the locust tribe have from time to time been notorious for this habit, not only on account of the countless numbers in which they have appeared, but also on account of the terrible destruction they have caused. As far back as the time of Moses their ravages are mentioned, for one of the plagues brought upon Egypt just before the departure of the children of Israel was the plague of locusts. In Asia, Africa and Europe their invasions have been recorded in history, both ancient and modern. To show the magnitude of the effects consequent on their migrations, I give a few instances, as taken by Dr. Packard from different historical sources. The first account, after Joel in the Bible, whose descriptions apply to Egypt, Syria, Palestine and Asia Minor, is the statement of Orosius that in the year of the world 3800 certain regions of North Africa were visited by monstrous swarms; the wind blew them into the sea, and the bodies washed ashore "stank more than the corpses of a hundred thousand men." Another locust plague, resulting in a famine and contagious disorders, according to St. Augustine, occurred in the kingdom of Masinissa, and caused the death of about 800,000 persons. Pliny states that the locusts visited Italy, flying from Africa. In Europe locust invasions have been recorded since 1333, when they appeared in Germany. Mouffit states that in 1478 the country about Venice was invaded, and 30,000 people died of famine. In France swarms appeared at the close of the Middle Ages. In 1747 there was a great invasion of Southern and Middle Europe. Before and after this date vast swarms were observed in Asia and Africa. In Russia, whose southern plains form the home of the locust, vast numbers have often appeared and done great damage. In China records exist of the appearance of these insects in devastating numbers 173 times during a period of 1,924 years. The three great causes of famine in China are placed as flood, drought and locusts.

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* The Moth emerged from the pupa referred to on the 27th of May, after being nearly two years in that state.

The new world has also its migratory locusts, equally destructive with those of the old. The Rocky Mountain locust, of which we all have heard so much, is not the only species. Central and South America have also their peculiar locust. Their ravages have been noted by the old Spanish chroniclers of Mexico and the adjacent countries from the time of the first conquest. In 1632 parts of Mexico were overrun with them, and in 1738 and '39 there was an invasion by them of the coasts of Oaxaca, after which a famine occurred in Yucatan. In 1855 and '56 Honduras and Guatemala were invaded, and a famine and pestilence of fever followed. And in 1835 Chili and the eastern part of South America were infested with vast swarms of locusts.

The Rocky Mountain locust *(Caloptenus spretus)* having been a subject of observation by the most eminent Entomologists of the United States, we know more about its habits and economy than about those of any other species. The terrible devastations it has committed in the Western States have led to this result. When an insect destroys the crops in one year to the estimated value of $45,000,000, it is about time to study its history and habits. Mr. Riley has published a most interesting book on the subject, and from this I have culled a few of the most striking items. Its home is on the elevated plateau of the Rocky Mountains, whence it migrates in favourable seasons to the west and south for hundreds of miles, laying waste the crops wherever it alights and doing terrible damage. It breeds in the regions to which it migrates, and the next generations migrate again north and west towards the "metropolis" of the species, and gradually die out on the way, while those that remain in the place of their birth also die out, so that the species becomes extinct in these localities in a few years.

The observations made, so far, give no special reasons for these migrations, unless it be the unusual abundance of the species and the consequent scarcity of food in its native regions. One or two favourable seasons cause the insect to increase to an immense extent, and when they find the supply of food failing them, they mount into the air in countless millions, and, favoured by a westerly or north-westerly wind, sail off towards the settlements in search of "fresh fields and pastures new." Such is the principal reason given by Packard, though he says possibly the reproductive instinct may also be concerned. And he does not think that these movements can be the result of a real migratory instinct, because their migrations (as well as those of the locusts of the old world) are periodical, long intervals sometimes existing between them, so that the development of a migratory instinct would be impossible. If once partially implanted, the long succession of non-migratory years would effectually break up the germs of such an instinct.

Another curious fact in connection with these locusts is, that the generation born in the region to which the species has migrated the previous year, shows a tendency to return north and west towards the primal habitat. This has been proved by repeated observation. One reason for this is found to be the prevalence of favourable winds at that particular season in the regions where these locusts are produced; for locusts, and indeed, all migratory insects, are dependent to some extent upon the winds for assistance and direction in their migrations. This is true for locusts all over the world; they are brought by the wind and taken away by the wind. A striking instance of this fact is given in the account of the great Egyptian plague of locusts in the Book of Exodus.

So with our American migratory locust. The general direction of the winds on the eastern slopes of the Rocky Mountains and on the plains is, during July and August, west or northwest. These are the months during which the locusts come down from their mountain home to invade the cultivated plains of the border States. And when the generation of which these are the parents attain the winged state, in the following June, it has been found that the prevailing winds are from the south and southeast, and thus are favourable to the flight of the locusts in a northerly or westerly direction.

As regards their powers of flight, it has been proved by experiment that the locust, when it has a favourable wind (and it rarely flies at any other time), does not fly faster than the wind, but merely uses its wings to sustain itself in the air, and allows the breeze to waft it along. An observer proved this by ascending to the top of the State University of Nebraska when a swarm of locusts was passing, and letting loose among the flying grasshoppers small bunches of cotton. He found that the cotton sailed along quite as fast as the grasshoppers did.

Their numbers are inconceivably great. A British officer who saw a swarm in Syria estimated their number at 180,000,000,000,000. The clouds of them seen in the west have often exceeded 50 miles in length by 20 in breadth, with a depth of from a quarter of a mile to a mile; 1,500,000 bushels of their dead bodies were estimated to be lying on the shores of Salt Lake, in Utah, after a visitatiou of their hordes. And their eggs are found in the ground in numbers of from 100 to 15,000 to the square foot, in localities favourable to their deposition. Such are some of the reliable statistics gathered regarding the Rocky Mountain locust.

A curious and fortunate fact with regard to the locust is that it does not become acclimated in the regions to which it migrates. The hordes from the north, fresh from the invigorating air of the mountains, are much stronger and more vigorous than their progeny born the succeeding year in the plains of Missouri and the other Western States. Professor Aughey, of the State University of Nebraska, tested their muscular strength by attaching their hind legs to a delicate spring balance and observing the degree of strength they exerted. He invariably found that the locusts from the mountains were stronger than those born in the plains. He also found that the mountain insects could live without food for several days longer than the others. Their eggs are also injured by the moister climate, so that it is estimated that fully one-half become addled and never hatch. These circumstances tend to so reduce their numbers in the new habitat that in a few years the species dies out.

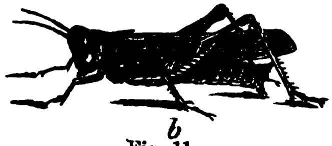

Fig. 11.

This locust is a near relation of our common Canadian locust *(Caloptenus femur-rubrum)*, fig. 11. The latter has often been injurious to the crops, particularly of grass and hay, but has little tendency to migrate. It has a vast range, from Labrador to the Pacific coast, including the Western States and Mississippi Valley as far south as 35°.

Leaving the locusts, we will pass to the more pleasing duty of noticing some migratory insects which are comparatively harmless, and are far more beautiful than any of the Orthoptera.

Many of the butterflies are inclined to migrations, particularly the whites and yellows *(Pieris, Colias* and *Callidryas)*. These genera, with a few exceptions, are not very plentiful in temperate regions, but have their home in warm climates. So from equatorial and South America, and from the southern parts of Europe have come reports of vast migrations of these butterflies. Bates, in his "Naturalist on the River Amazon," gives an interesting account of the uninterrupted procession of butterflies belonging to the genus *Callidryas* which he saw passing from morning to night in a southerly direction across the

Amazon. In these cases migrations may perhaps be connected with the question of food, or of the continuance of the species.

A butterfly which is well known in Canada, and which has a very wide range, is noted for its migratory habits; it is the *Danais archippus* (fig. 12). Hardly a season passes but we read of its migrations. Newspapers in the Southwestern States, and the weather signal officers, were constantly reporting the passage over Iowa, Kansas, Missouri and Texas of swarms of this butterfly during the months of September and October last. Even in Canada they are sometimes seen in great numbers on their way either north or south. I myself have seen the shore of Lake Ontario, near Brighton, strewn with hundreds of their dead bodies, cast up by the waves, and which no doubt had formed part of a swarm which from weakness or some other cause had perished while flying across the lake.

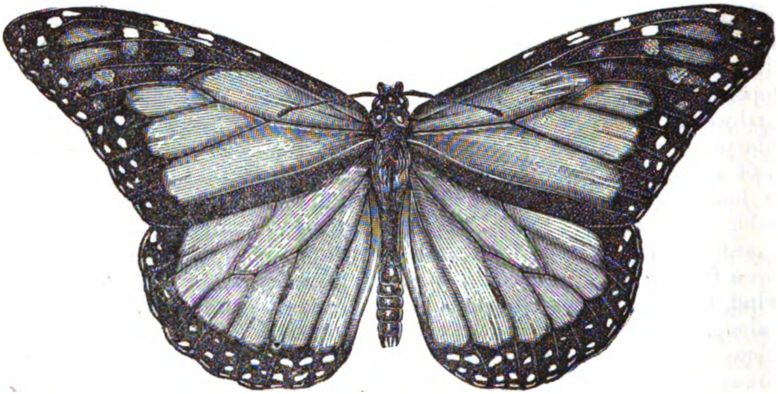

Fig. 12.

Mr. Riley gives an interesting account of the causes which may lead to the migrations of this butterfly in his third report. He says:—"It would be difficult to give any satisfactory reason for this assembling together of such swarms of butterflies. As I have abundantly proved by examination of specimens, the individuals composing the swarms of our Archippus butterfly comprise both sexes; if anything the females prevail. The flights almost always occur in the autumn, when the milk-weeds (*Asclepias*), upon which the larva of this butterfly feeds, have perished. The instinct to propagate is, therefore, at the time in abeyance. The butterflies, unable to supply themselves with sweets from flowers, are either attracted in quantities to trees that are covered with honey-secreting plants, or bark lice; or else they must migrate southward, where flowers are still blooming. The Archippus butterfly hibernates within hollow trees and other sheltered situations. Southerly timber regions offer most favourable conditions for such hibernation. Under the most favourable conditions a large majority perish. A small portion of the females survive the winter. Such hibernating individuals, upon waking from their winter torpor, make at once for the prairie, where the milk-weeds most abound. Faded, and often tattered, they may be seen flying swiftly over such prairies.

"I have no doubt but that they travel thus for many hundred miles, keeping principally to the north, and ere they perish, supplying the milk-weeds here and there with eggs. A fresh brood is produced in less than a month, and these extend still farther north, until we find the species late in the growing season as far up as the Saskatchewan country, where it can scarcely successfully hibernate, and from whence the butterflies instinctively migrate southward. We can thus understand how there are two, three or more broods in southerly regions, and only one towards British America.

"The exceptional flights noticed in the spring, and which, so far as recorded, take place quite early and in the same southerly direction, find a similar explanation. They may be looked upon as continuations of the autumn flights. Hibernating in the temperate belt, they are awakened and aroused upon the advent of spring, to find the milk-weeds not yet started, and they instinctively pass to more southern regions. There is a southward migration late in the growing season in congregated masses, and a northward dispersion early in the season through isolated individuals."

It will thus be seen that Mr. Riley looks upon the migration of *D. archippus* as something analogous to the southern movement of the birds on the approach of winter, the object in both being the preservation of the species; in the case of the insect to obtain a suitable place for hibernation, as well as a continued supply of food until the time of hibernation arrives; in the case of the bird to secure food when it would be difficult or impossible to get it in a northern climate. The instinct of the butterfly might therefore be looked upon as a true migratory instinct, in contradistinction to that of the locust, which is of a lower order.

There is another butterfly which displays this instinct to a large extent. I refer to the well-known *Pyrameis cardui*, or painted lady. It is a cosmopolitan butterfly, being found in all parts of the world—a result, no doubt, of its migratory habits, conjoined to a faculty of acclimatization. Though I have never actually seen a migration of this insect, I have had no doubt for years past that one did take place in the vicinity of Quebec, I think in 1865 or '66. I had been looking out for the insect for several years, but never saw a single specimen till one summer, when it suddenly became the most common butterfly in the neighbourhood. They could be seen by dozens everywhere. Next year it was not to be found, nor did it return during my stay in Quebec, up to 1872.

I have an idea that others of the genus *Pyrameis*, as well as the species of the allied genera, *Grapta* and *Vanessa*, have these migratory habits to some extent. The same phenomenon, that of scarcity, then extreme abundance for one season, and then disappearance, took place with regard to *Vanessa j-album*. They were so abundant one summer that I even saw them drinking spruce beer from the old applewomen's kegs on the Upper Town Market, Quebec, while next season the only specimen I found was a poor dilapidated individual which I took snugly tucked away under the coping of a fence, where it had evidently passed the winter.

As I said before, the fact of *Pyrameis cardui* being found in all the four quarters of the globe is no doubt due to its migrating propensity. A further proof of this is found in the well-known fact that our *archippus*, originally confined to America (though ranging from Canada to Bolivia), has lately spread over some of the islands of the Pacific to Queensland and New Guinea, and over the Azores to Europe, such extension of habitat necessarily indicating great power of long-sustained flight. Since the Milk-weeds are not plants of commercial value, it is highly improbable that the species has been carried in any of its preparatory states in ships. The fact remains, however, that it has been found as a new inhabitant of those countries. Its powers of flight will hardly be doubted by any one who has attempted to catch it on the wing. But a stronger proof was the exhibition of a *D. archippus* some years ago, by Mr. Pearson, of Montreal, which had been captured on board a ship on the Atlantic, hundreds of miles from land.

On some Long-horned Beetles.

Clytus.

By R. V. Rogers, Jr., Kingston, Ont.

Among the Coleopterous hosts there is a family called Long-horns, or Capricorns, in vulgar parlance; or *Cerambycidæ*, when we are talking learnedly. They derive these names from the fact that they possess very long antennæ (sometimes longer than their bodies), which are generally re-curved like the horns of a wild goat (the Latin *Caper*). They form a very large family; already 4,000 of them are known and recognized by the scientific world. They comprise some of the largest, most showy, as well as most destructive, of the beetles; one of African origin—*Prionus Hayesii* by name—is five inches long and one broad, with antennæ of seven inches and legs of four. The Long-horns are world-wide, and their abundance is in proportion to the richness of vegetation of different countries, so that South America, India, Ceylon and the Moluccas contain a great number of the most beautiful and the largest capricorns.

They have earned the name of Borers because they are, in fact, "animated gimlets," and spend their lives while in the larval state in perforating and feeding upon trees; some live and carry on their operations in the trunks, others in the branches; some devour the wood, others the pith; some are found only in shrubs, some in the stems of herbaceous plants, others confine their attentions to the roots. Some are to be found only on one species of plants, others have a wider range. Some bore straight holes, others branch off at divers angles, others make tracks as various as those of an engraver, while some are regular screws. The Germans, lovers of music, as they are, call these beetles "Fiddlers," because they give forth, especially when annoyed or taken in the hand, a squeaking or rasping noise produced by rubbing the joints of the thorax and abdomen together. Some of the family are not only musical-boxes, but scent bottles as well, and emit a fragrant odour not unlike that of otto of roses.

The members of this family, as a rule, are very handsome, and readily attract notice by their elegant forms and resplendent attire, that is, when of full age; when young—in the creeping age—they are ugly in the extreme. Harris tells us that the various members of the family resemble each other in the following respects: the antennæ are long and tapering. The body is oblong, approaching to a cylindrical form, a little flattened above, and tapering somewhat behind. The head is short and armed with powerful jaws. The thorax is either square, barrel-shaped or, narrowed before, and is not so wide behind as the wing-covers. The legs are long; the thighs thickened in the middle; the feet four-jointed, not formed for rapid motion, but for standing securely, being broad and cushioned beneath, with the third joint deeply notched. Most of these beetles remain upon the trees and shrubs during the day time, but fly abroad at night. Some of them, however, fly by day, and may be found on flowers, feeding on the pollen and blossoms.

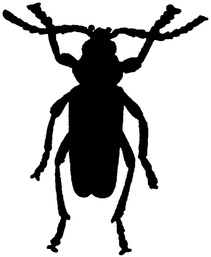
Fig. 13.

The pride of our Canadian forests, the maple tree, suffers much from the attacks of *Clytus speciosus* (fig. 13), the largest of our native members of the family. This beautiful beetle is easily recognized; it is about in inch in length, and the third of one in breadth. The head is yellow with antennæ and eyes of reddish black. In shape the body is somewhat cylindrical, a little flattened above and tapering behind. The thorax is black with two yellow transverse spots on each side. The wing covers for more than half their length are black, for the rest they are yellow; they are gaily ornamented with bands and spots arranged as follows: A yellow spot on each shoulder, a broad yellow curved band or arch, of which the yellow scutel forms the keystone, on the base of the wing covers; behind this a zig-zag yellow band forming the letter W; across the middle another yellow band arching backwards, and on the yellow tip a curved band and a spot of a black colour; the legs are yellow.

The under side of the abdomen is reddish yellow, variegated with brown. The female has the advantage of her mate in size, but her antennæ are somewhat shorter. She possesses a pointed tube at the end of the abdomen, through which the eggs are passed from her body into the cracks and crevices of the bark. The tube can be contracted or extended at the will of the fair owner and to suit the emergency of the case.

The parent lays her eggs on the bark of the maple in July or August. As soon as the grubs are hatched they burrow into the bark, and there find protection during the cold of winter. When the warm days again return the larvæ begin again their labours, penetrating deeper and deeper into the heart of the tree, sometimes tunnelling as much as three inches into the solid wood, they make long and winding galleries up and down the trunks. A carpenter is known by his chips, so their presence is readily detected by the little heaps of sawdust that they throw out of their work-shops. If in time a stiff wire is inserted into their holes they can be easily put an end to by impaling. They are long, whitish, fleshy, deeply marked by transverse cuts; their legs, although sixteen in number, are merely rudimentary promises of legs, and for ornament, not use; they are of no avail for the purpose of locomotion. Not by means of their eight pairs of legs, but by alternately contracting and extending the segments of their bodies, do these worm-like creatures force their way along, and in order to assist their progress each segment is furnished with fleshy tubercles capable of protrusion, and which being pressed against the sides of their retreats, enable them to thrust forward by degrees the other segments (Ent Rep., 1872, p. 36).

The head is the box of tools with which they saw and cut their way through the wood; their work "is done slowly but effectively, and their gnawing teeth, though slow in action, are as resistless as the mordant tooth of time."

About midsummer these busy little carpenters who have never seen the light of day, unless by accident, strike—not for higher wages but for a higher stage of existence; they labour no more, but in the innermost recesses of their living homes fold themselves up snugly for their pupa sleep. At first the nymph is soft and whitish, but gradually it hardens and darkens till at last it lies enwrapped in a filmy veil, beneath which all the external parts of the future beetle are visible. The wings and the legs are folded calmy on the breast, while the long antennæ are turned back against the sides of the body and then tucked up between the legs. When at length it has become matured, it breaks its slumbers, forces its way through the bark, and comes out of its dark and narrow retreat to see the world and enjoy for the first time the glorious light of day and the pleasures of legs and wings, and love and passion, and to propagate its race.

Clytus pictus Drury, or the Painted Clytus, is another of our common species. Its form is very similar to that of *C. speciosus*, and it varies from six-tenths to three-fourths of an inch in length. Harris thus describes it: It is velvet black, and ornamented with transverse yellow bands, of which there are three on the head, four on the thorax, and six on the wing-covers, the tips of which are also edged with yellow. The first and second bands, on each wing-cover are nearly straight; the third band forms a V, or united with the opposite one, a W, as in *speciosus*; the fourth is also angled, and runs upwards on the inner margin of the wing-cover towards the scutel; the fifth is broken or interrupted by a longitudinal elevated line, and the sixth is arched and consists of three little spots. The antennæ are dark brown, and the legs are rust-red.

Clytus Robiniæ, Forster.—According to Walsh, the male of this species differs from *C. pictus* in having much longer and stouter antennæ, and in having its body tapered behind to a blunt point, while the female is not distinguishable at all. This insect does great injury to the locust and acacia trees, and appears in the perfect state in September. Harris confounds this with *Clytus pictus;* in fact, it was long considered by Entomologists to be identical with it. It has sometimes been known as *Clytus flexuosus*, Fab.

During comparatively late years *Robiniæ* has been extending its sphere of operations. For a long time it was known only in New York. Some thirty years ago it appeared in Chicago, and in 1863 it was seen two hundred miles further west. In 1855 it was first observed in Montreal; in 1862 it was very destructive to the locust trees around Toronto; In 1873 Mr. E. B. Reed saw it in enormous numbers in London, Ont. Now it seems to be quite at home in all parts of Ontario. Harris, speaking evidently of this, though under the name of *C. pictus*, says: "In the month of September these beetles gather on the locust trees, where they may be seen glittering in the sunbeams, with their gorgeous livery of black velvet and gold, coursing up and down the trunks in pursuit of their mates, or to drive away their rivals, and stopping every now and then to salute those they meet, with a rapid bowing of the shoulders, accompanied by a creaking sound, indicative of recognition or defiance. Having paired, the female, attended by her partner, creeps over the bark, searching the crevices with her antennæ, and dropping therein her snow-white eggs, in clusters of seven or eight together, till her whole stock is safely stored. The eggs are soon hatched, and the grubs immediately burrow into the bark, devouring the soft inner substance that suffices for their nourishment until the approach of winter, during which they remain at rest in a torpid state. In the spring they bore through the soft wood, more or less deeply into the trunk, the general course of their winding and irregular passages being in an upward direction from their place of entrance. For a time they cast their chips out of their holes as fast as they are made, but after a while the passage becomes clogged, and the burrow more or less filled with the coarse and fibrous fragments of wood, to get rid of which the grubs are often obliged to open new holes through the bark. The seat of their operations is known by the oozing of the sap and the dropping of the saw-dust from the holes. The bark around the part attacked begins to swell, and in a few years the trunks and limbs will become disfigured and weakened by large porous tumours, caused by the efforts of the trees to repair the injuries they have suffered. . . . The grubs attain their full size by the 20th of July, soon become pupæ, and are changed into beetles and leave the trees early in September. Thus the existence of the species is limited to one year."

Space will not permit me to speak of the other members of this interesting and beautiful family—*nobilis*, *luscus*, *campestris*, *undulatus*, *longipes*, etc., each one of which is well worthy of a full description and biography.

SOME NOTES ON COLEOPTERA FOR BEGINNERS.

By C. G. Siewers, Newport, Ky.

In answer to a query in the March *Entomologist* as to the rearing of larvæ of wood-boring beetles, I would say that it is very difficult to do after they have been removed from their burrows. Try damp sawdust of the same wood. The better plan where infested timber is found, is to saw into short lengths, pack in tight box and cover with a wet cloth. Many kinds cannot bore in dry wood. Many Buprestidæ perish from inability to perforate the bark of dead trees which has sprung loose from the wood and become hardened by the sun. They then fall an easy prey to ants, roaches and caribs. Where wild grape vines abound, cut them off at the ground in May or June, and let them hang; in early spring saw them into short lengths and box them, and some rare beetles may be taken. Grubs under stones put away in the same ground in tin or glass, kept moist; found under logs, use the log debris, and add some sawdust. Finding two very large grubs with black heads under a log late in the fall, I put them away in a tin can with log refuse and sawdust, and found a male ash beetle and a dead pupa in July. This beetle, *Xyloryctes satyrus* (Fab.), is taken under the roots of ash trees, and falls a victim to its curiosity, for if you begin to dig for them they will come out to see what is going on. I took fifteen from one tree in that way. April and May are generally devoted to searching in logs and dead trees for beetles, when many nymphs can be collected, which can generally be hatched out in a week or two. June and July are the great beating months. I have discarded the beating net for the inverted umbrella, and so will any one who has tried both, as beating the low limbs of trees around the edges of wood will yield tenfold the quantity and variety that bush and weed beating will. Woods protected from cattle and hogs, and full of vines and bushes, are best. Little is got by beating in the interior of woods. Insect life swarms along the edges. Examine the trunks of trees, and where flat stones abound scoop out cavities under them, where Cychrus and various caribs may be trapped; Cychrus are snail-feeders, and some bait traps with snails strung on strings through the shell. The beans of the honey locust yield *Spermophagus Robiniæ*; the fungus puff-ball, *Lycoperdina ferruginea*; all kinds of fungus swarm with beetles, also *Staphilinidæ*. *Pselaphidæ* are taken on the under side of stones, but mostly by sifting around decayed stumps on to a white cloth. Beat wild plum trees and haws when in blossom. Where beetles are found, by carefully replacing stones and bark more may be taken, as their scent remains. I was glad to take a single specimen of that rare and handsome longicorn, *Dryobius sexfasciatus*, in one season, but in the summer of 1878 I found five under one piece of bark of beech; so last season, when I found a small colony under bark on a dead maple, I tied the bark on again, and took seventeen more at different visits. Various beetles are also found on fruit and flowers. In closing, I would advise beginners to put small insects on paper slips or wedges, and not pin them with a No. 2 pin, as it cannot be inserted in cork without plyers, and is very liable to buckle. No. 3 enters cork readily, is not too large for paper slips, and about right for larger specimens. Further, do not use Spaulding's glue; it will turn your wedges brown, as it contains a discolouring acid. Make your own liquid glue—better at one-fourth the cost. Dissolve light coloured glue or isinglass in the usual way: then, while hot, stir in alcohol, or a light coloured, strained vinegar, till it is thin enough, and decant into a bottle. It can then be thinned with a little water, or by warming.

A New Enemy of the Black Spruce, Abies Nigra.

By Dr. H. A. Hagen, Cambridge, Mass.

An enemy of *Abies nigra* sent to me by Mr. C. S. Sargent, from the Arboretum of Harvard University, induced me to compare the literature about the enemies of this tree. To my surprise, all that is published consists of two very excellent papers by Mr. Ch. H. Peck, Albany. One, "The Black Spruce," read before the Albany Institute, May 4, 1875, 8v., pp. 21 ; the other in the New York State Museum's Report of the Botanist, No. 30. I do not remember to have seen these papers recorded in entomological serials. There are noted two vegetable parasites, *Arceuthobium pusillum* and *Peridermium decolorans*. Of insects are recorded a plant-louse near *Adelges coccineus*,and some Hemipterous gall imsect; also, two beetles, *Hylurgus rufipennis* and *Apate rufipennis*.

The twigs sent to me contained numerous pale spots, the consequence of some dead leaves, three or more, one near the other. The examination of those leaves showed on every one at the base, sidewards, a small round hole. The interior of the leaf was hollow, in some cases only the lower half, where the enemy had not yet finished the work. I discovered directly a small caterpillar, belonging to Tineidæ and probably to the Argyresthians, as the destructive enemy. The biological collection contains no enemy of the black spruce, and no similar destruction of pines, except a somewhat related twig of *Pinus Canadensis*, quoted also as probably done by an Argyresthian larva. In Mr. Chambers' valuable list no Tineid living on spruce is recorded.

The European literature contains only one fact similar to the American. It is recorded that *Cedestis farinatella* hollows the leaves of pines. But until now no American species of *Cedestis* is known. Probably the moth will be raised and the mystery solved; at all events, I desire to draw the attention of entomologists to this enemy. Perhaps it may be more common than is supposed, Prof. Peck stating as a fact that the spruce trees in some parts were said to be dying at an unusual rate, as if affected by some fatal disease. To judge by analogies, the attack made by *Hylurgus* and *Apate* is only a consequence of the previous attacks by other enemies.

Notes of the Swarming of Danais Archippus and Other Butterflies.

While spending the winter of 1875-76 in Apalachicola, Florida, I found one of these *archippus* swarms in a pine grove not far from the town. The trees were literally festooned with buttterflies within an area of about an acre, and they were clustered so thickly that the trees seemed to be covered with dead leaves ; fig. 14 will enable the reader to form some idea of their appearance thus grouped. Upon shaking some of the trees a cloud of butterflies flew off, and the flapping of their wings was distinctly audible. They hung in rows (often double) on the lower dead branches, and in bunches on the needles. I find by my note book that visiting the flock towards evening, it was receiving additions every moment. I caught a net full off a bunch of dead needles, and walking away to some distance and letting them go, all but three returned to the flock. The question as to where they came from seems a very interesting one. I was told by Dr. A. W. Chapman that there was hardly milkweed enough in all Florida to produce one of these flocks, which doubtless do not confine themselves to Apalachicola. During my visit I found two more flocks

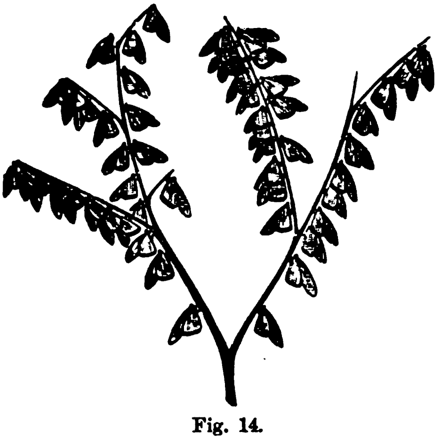

Fig. 14.

not far from the first, but neither of these was as large. I should mention that I often observed examples among them *in coitu.*

I have seen *archippus* flocking at the Isles of Shoals, N.H., towards evening, in very much the same manner, having flown nine miles from the mainland. I have also seen clusters of *Vanessa J-album* on tree trunks at dusk in New Hampshire, which seemed to present a parallel to the *archippus* flocks, though of course on a very small scale.

R. THAXTER, Newtonville, Mass.

The assembling of *D. archippus* is perhaps not so frequently noticed as their passing over localities in flocks. Several years ago I saw them congregating in a bit of woods in the neighbourhood of the city which I was visiting at the time. At least every other day they were hanging in a listless kind of manner to the underside of branches in immense numbers, with their wings closed, and not noticeable unles disturbed, very few being on the wing. Their favourite resting place seemed to be dead pine twigs, which would be drooping with their weight, and in more than one instance I saw one too many light and the twig snap, and send a dozen or more into the air to seek for another perch. In going to and from the woods I have seen several of them at once coming from different directions, high in the air, sailing along in their own easy and graceful way, all converging to the one spot. I did not see them depart. I went one day and could not find one in the woods; and as there were thousands, perhaps hundreds of thousands of them, it would have been a fine sight to see them go. The following year they were remarkably scarce, and it was three years before they were even moderately plentiful.

J. ALSTON MOFFAT, Hamilton, Ont.

A very remarkable gathering of *Danais archippus* came under my observation, at Racine, Wisconsin, in the first week of September, 1868. The insect appeared in great numbers, and gathered in several swarms about trees in the vicinity. The day was cloudy, but without rain. Shortly after noon the swarms seemed to gather, and settled upon a tree in my garden, a well-formed black oak about 15 inches in diameter at the trunk, and perhaps 40 feet high. The swarm covered the southern aspect of this tree so abundantly that the green of the leaves was quite obscured by the brown of the wings of the butterflies. A few sailed back and forth through the air as if seeking a place to alight, when the wings of those sitting, opening and shutting as if by a single impulse, caused the prevailing colour to shift from the dark hue of the upper surface to the lighter colour of the lower surface. They remained until after nightfall, but were gone when we looked for them in the morning. No attempt was made to capture or count them, but the swarms must have contained some thousands.

S. H. PEABODY, Champaign, Ills.

During the first week in July I found *Melitæa phæton* in considerable quantities in a small clearing in Dow's swamp, about one mile south of this city. The swamp is densely wooded with tamarack and a thick undergrowth of *Myrica gale*, *Salices*, *Alnus incana*, etc., besides many herbaceous plants, and among them (but not at all plentiful) *Chelone glabra*. Upon inquiry, I find that this clearing was the exact locality where the late Mr. B. Billings found this butterfly in 1870.

J. FLETCHER, Ottawa.

Prof. J. E. Willet, of Macon, Georgia, writes under date of 19th January, 1880:—"I saw *Callidryas eubule* passing here in great numbers during Sept., Oct. and Nov., 1878, from N.-W. to S.-E. About noon, when they were most abundant, there would be half a dozen visible all the time, crossing a 15-acre square of the city. They pursued an undeviating course, flying over and not around houses and other obstructions. They flew near the ground, and stopped occasionally to sip at conspicuous flowers. A ger^nium with scarlet flowers, and set in the open yard, attracted most that flew near it. Papers in southern Georgia noticed the great numbers passing at different points; and a friend in southern Alabama sent me specimens of the same, saying that they were subjects of speculation there. About March, 1879, there was a similar migration from S.-E. to N.-W., but in diminished numbers. I saw the fall migrations again Oct. and Nov., 1879, but in smaller numbers than in 1878. A lady of southern Georgia told me that her husband called her attention to the fall migration twenty-six years ago, and that she had observed it every year since. *C. eubule* is found here in small numbers at other seasons of the year."

In the course of the last two or three years several accounts have appeared in *Nature* of the flight of Lepidoptera in large numbers. I observed a similar phenomenon in 1870, which may present sufficient interest to be put on record. In the summer of that year, in the month of August as well as I remember, I was crossing the harbour of this city in the 3 p.m. trip of the steam packet-boat between the city and Moultrieville, on Sullivan's Island, at the entrance of the harbour, a summer resort of the inhabitants of our city. The distance is between four and five miles, and when about half way or perhaps two-thirds, the steamer passed through an immense stream of butterflies crossing the harbour towards the S.-W. They were all of the genus *Callidryas*, whether *C. eubule* or *C. marcellina* (if indeed they be different species) I could not determine. The wind was light, and from the rapid motion of the vessel, it was difficult to say whether the insects were aided or opposed by it in their transit. As the vessel passed obliquely through the stream, their rate of motion could not be determined, and the dimensions of the stream only roughly estimated; it seemed to be six or eight yards wide, about as many high, and extended a hundred yards or more on each side of the vessel. Whence they came or whither they went could not be ascertained; they seemed to be crossing the harbour in a direction nearly parallel to the general travel of the coast.

LEWIS R. GIBBES, Charleston, S. C.

APPOINTMENT OF STATE ENTOMOLOGIST FOR NEW YORK.

We learn with much pleasure that our esteemed friend and valued contributor, Mr. J. A. Lintner, of Albany, N.Y., has received the appointment of State Entomologist. A better qualified man for the position could not, we believe, be found. Mr. Lintner has for the past thirty years devoted a large portion of his time to the study of Entomology, and paid especial attention to that practical department of the science which treats of insects injurious to agriculture. The enormous loss occasioned yearly by destructive insects, is now well known, and every means discovered to prevent or lessen these ravages results in a large yearly gain to the cultivators of the soil. The special business of the State Entomologist will be to endeavour to ascertain how this desirable end can best be accomplished. We anticipate good results from this judicious appointment.

OTTAWA FIELD NATURALISTS' CLUB.

TRANSACTIONS NO I.

The records of the first year's efforts of this active and enterprising organization fill a goodly octave pamphlet of sixty-two pages, which is adorned with two excellent plates. From the annual report of the Council, contained therein, we learn that the Club has a membership of over eighty, and that five excursions, for the purpose of collecting objects of natural history, have taken place during the year, with an average attendance of thirty. During the winter months a successful series of soirees were held, seven in number, at each of which interesting papers were read by members, and the specimens collected on the excursions exhibited. Many of the papers are published in the Transactions; also a list of plants collected in the Ottawa district by the energetic Vice-President, Mr. James Fletcher.

In the successful maintenance of this Natural History Club, Ottawa has set a noble example, which we trust will be speedily followed by similar organizations in other cities of our Province.

OBITUARY.

Professor Samuel Stehman Haldeman, of the University of Pennsylvania, a distinguished naturalist and philologist, and at one time President of the American Philological Association, died on Tuesday evening, September 10th, at his residence in Chickis, near Columbia, Pa., aged sixty-eight years.

Professor Haldeman has long been noted also for his devotion to Entomology. He attended the late meetings of the Entomological Sub-section of the American Association for the Advancement of Science, at Boston, in August, and took an active part in the discussions. At that time he seemed to be in good health and spirits. By his genial disposition and open generous bearing he has endeared himself to a large circle of friends, who will sincerely mourn his loss.

NOTES ON SOME RARE INSECTS CAPTURED IN ONTARIO DURING 1880.

By Wm. Saunders, London, Ont.

LIBYTHEA BACHMANI.

Twelve years ago, in August, 1868, a specimen of this butterfly was captured on the beach, in Hamilton, by Miss Mills, and a record of this capture, with some observations on the insect, appeared in the November number of the CANADIAN ENTOMOLOGIST for that year. We have no evidence of its having been found before this, and no records of any such capture since, until the present season, when a good specimen was taken by Mr. J. M. Denton, at Port Stanley.

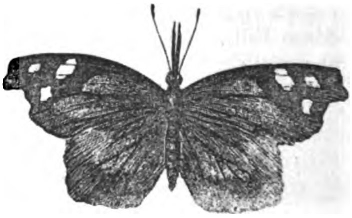

Fig. 15.

In fig. 15, we give a representation of this species, which is remarkable for its very long palpi—fully one-fifth of an inch in length, and presenting the appearance of a beak; brown above, whitish below.

The wings are angular, and expand about an inch and three quarters. The fore wings are dark brown, with three white spots arranged in a triangle near the tip; the upper inner one largest, oblong, and irregular in form; the lower one is also oblong, but smaller, and the outer one smallest. Beyond the middle of the wing there are two large fulvous spots, the upper one elongated and pointed at both ends, the lower one oblong, irregular, and divided near the middle by a dark brown nervule. The hind wings are dark brown above, with a large, irregular, fulvous patch across the middle.

The under side of the fore wings is paler than the upper, with the same white spots and fulvous markings, the latter somewhat larger than above. The hind wings have a wide brown border on the hind margin, within which they are bluish, iridescent and streaked with brown.

I am not aware that any description of the larva of this butterfly has ever been published.

Papilio Philenor.

This beautiful butterfly, common in the Southern States has usually been very rare in Canada. The general appearance of the insect is given in fig. 16, but it is impossible with a woodcut to give any idea of the brilliancy of the colouring. The fore wings are black, with a rich greenish metallic reflection, and a row of white spots, absent in the male, near the hinder margin which is slightly undulating and partly edged with white. The hind wings are of a brilliant metallic bluish green, with six white spots and some streaks of the same colour on the margin.

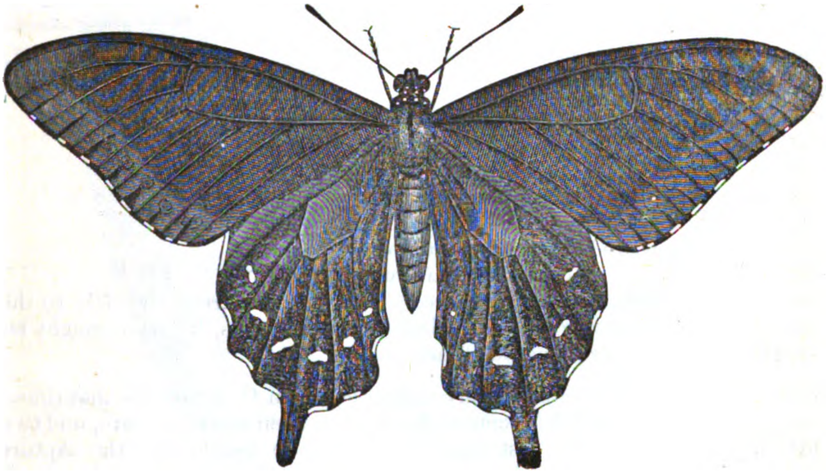

Fig. 16.

The under side of the fore wings is of a dull black colour, with the white spots more distinct. The hind wings are very brilliant, with the exception of a large patch at the base, they are of a beautiful steel blue colour, with a curved row of seven orange coloured spots bordered with black, and the upper ones partially edged with white. There is a small yellow spot at the base and a few whitish dots about the middle of the wing, while the marginal bordering of white is replaced by a series of yellowish white spots, growing larger as they approach the upper part of the wing. The male is more brilliant in colour than the female.

This lovely insect is produced from a rather handsome though peculiar looking caterpillar (fig. 17) about two inches long when fully grown, of a black colour with a purplish

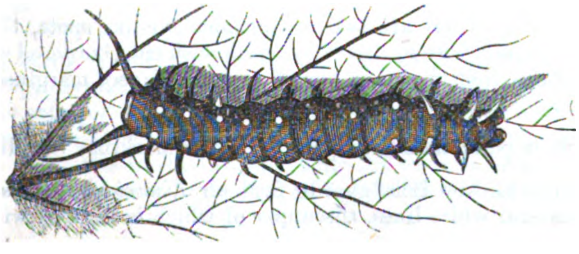

Fig. 17.

hue. Immediately behind the head there are two long movable fleshy horns and a number of shorter horns, and orange coloured tubercles on the remaining segments. The eggs are laid by the butterfly, on different species of *Aristolochia*, chiefly on the Dutchman's pipe (*Aristolochia sipho*) and the viginia snake root (*Aristolochia serpentaria*). The larvæ feed in company and when plentiful will sometimes entirely consume the foliage of the plants on which they feed.

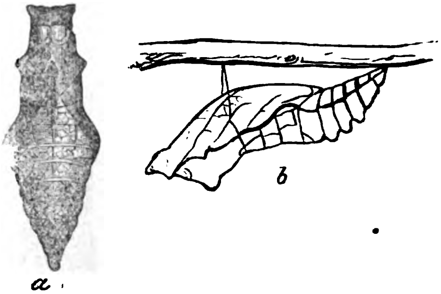

Fig. 18.

Fig. 18 represents the chrysalis of this insect, which is fastened at the hinder extremity to a mass of silken threads and has a band of the same material extending entirely around the chrysalis, beyond the middle.

In the August number of the *Canadian Naturalist and Geologist*, for 1858, an account is given by the Rev. C. J. S. Bethune, of the appearance of a very unusual number of these butterflies, in West Flamboro'. The writer says, "these butterflies appeared in countless numbers about the lilac trees, as long as they continued in blossom, and then suddenly disappeared. They lasted from the 7th to the 18th of June, but very few appearing after that date." He also says, "I have caught but two in Toronto, though they were numerous there also.

No such good luck has befallen any entomologist in Ontario since that time. Within these twenty-two years several specimens have been taken about Toronto, and two or three some fifteen years ago at Woodstock. There are no records of the capture of this butterfly here for many years past, but this season a specimen was caught by Mr. J. A. Moffat, at Ridgeway, Ontario.

JUNONIA LAVINIA (*Cœnia*).

The first recorded occurrence of this butterfly in Ontario, is found in the November number of the *Canadian Journal*, for 1861, where an account is given by me of the capture of three specimens, at Port Stanley, two by Mr. Wm. Edwards and one by myself. During the same season it was found in the townships of Ellis and Logan, about ten miles north of Stratford. For very many years past I have not heard of a single specimen being taken in Ontario, until this season, when it was captured by Mr. Moffat, at Ridgeway, and by Mr. Denton at Port Stanley.

It is a very pretty insect. The general colour of the upper surface is brown. On the fore wings there is a broad whitish band, extending nearly across the wing and enclosing near the hinder angle a large black eye-like spot, with a central bluish dot and encircled by a yellowish brown ring. In some specimens a second and very small spot is situated near the tip outside the band. There are also two smaller, short, red bands bordered between the white band and the base of the wing.

On the hinder wings there are two conspicuous eye-like spots, the under one much smaller than the upper, and both encircled by a yellowish ring, bordered with black. Between these eye-spots and the hind margin is placed a band of red, margined externally by one or more dark lines.

The under side is paler than the upper, with the markings less distinct.

The caterpillar is said by Boisduval to feed on *Linaria canadensis*. It is black and spinous with two lateral white lines, the upper of which is marked with a row of reddish spots.

PAPILIO CRESPHONTES.

In our report for 1878, reference was made to this handsome swallow-tail butterfly, and a figure given of it, but as this report may not be available to many of our readers, we shall reproduce it here (see fig. 19). Since 1878 it has become more common, and has been reared from the larva by collectors in Hamilton, as well as by myself. They have been found chiefly on prickly ash (*Xanthoxylum fraxineum*), and on *Dictamnus fraxinella.* This year I found the caterpillars, nearly full grown, in June, which shortly entered the chrysalis state, and produced the butterflies in about a fortnight afterwards. I have also taken the full-grown larvæ late in the fall, which passed the winter in the chrysalis state, from which facts the inference may be fairly drawn that this butterfly is double-brooded in Ontario.

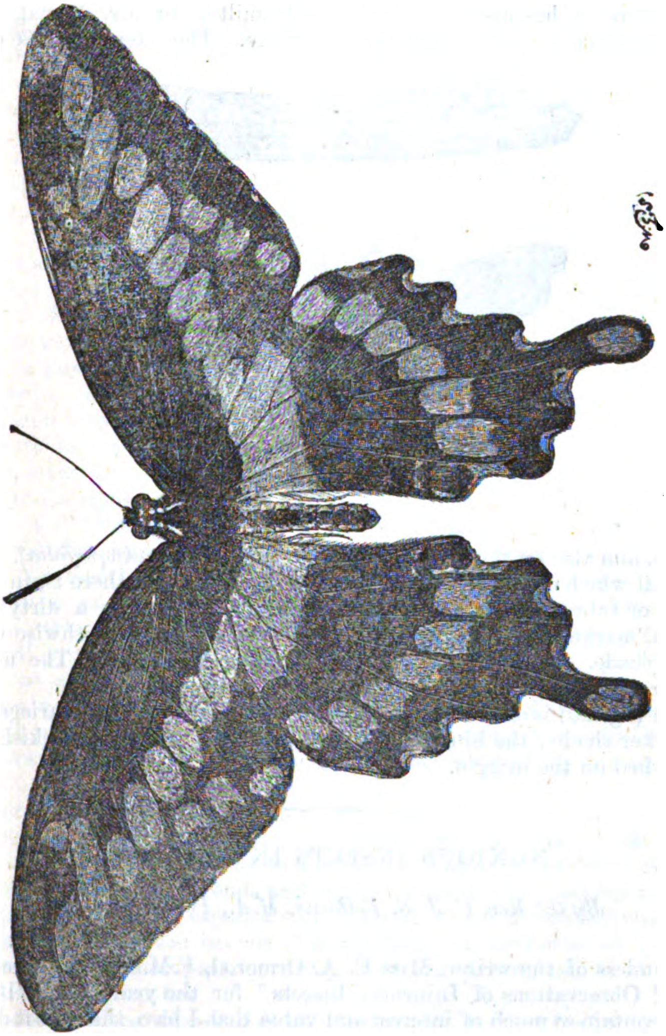

Fig. 19.

The wings of this stately insect are black, streaked and spotted with yellow, as shown in the figure. The caterpillar is a very singular looking creature; it is brown, with large, irregular patches of white; the chrysalis is brown, marked with blackish points. For a more minute description the reader is referred to the report for 1878.

The Abbot Sphinx (*Thyreus Abbotii*).

This pretty sphinx moth has been captured in London, during the present season, by Mr. J. M. Denton; it has also been taken in Hamilton, by Mr. Moffat and Mr. David Little, and is reported as having been common there. The caterpillar (see fig. 20) feeds on the grape vine, and also on the Virginia creeper (*Ampelopsis quinquefolia*). In place of the horn at the tail which caterpillars of this family usually have, there is, in this instance, a polished knob or tubercle. The colour of the larva varies from a dirty yellowish to a reddish brown, marked transversely with fine black lines, and lengthwise with patches of a dark brown shade. There is also a dark line along each side. The under surface is paler, with a reddish tinge along the middle.

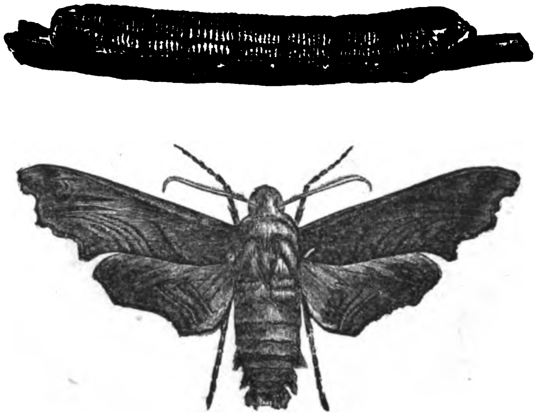

Fig. 20.

The moth (fig. 20) is of a dull pale brown colour, the fore wings variegated with brown of a much darker shade; the hind wings are yellow, with a broad blackish border. Both wings are notched on the margin.

NOXIOUS INSECTS IN ENGLAND.

By the Rev. C. J. S. Bethune, M.A., Port Hope, Ont.

By the kindess of the writer, Miss E. A. Ormerod, F.M.S., I have recently received her "Notes of Observations of Injurious Insects" for the years 1877, 1878 and 1879. These reports contain so much of interest and value that I have thought it desirable to give to our readers some extracts from them that bear upon our own insect enemies, and at the same time draw attention to the valuable work that is being quietly done in England by a band of volunteer workers who, apparently, receive no recognition or encouragement from the Government or the general public. The plan pursued has been to send out a circular in the spring of the year, to a large number of observers scattered over Great Britain, and to recommend to them a list of insects for observation during the season. The replies sent in in the autumn are carefully collated by Miss Ormerod, and the systematized results published during the winter in an octavo pamphlet, illustrated with excellent wood cuts. It is pleasing to observe a steady growth in these reports; that for 1877 contains 19 pages and 12 cuts; that for 1878, 27 pages and 20 cuts; and the last, 44 pages and 27 cuts—

some of the latter are, of course, reproductions of those that appeared in the earlier issues. The insects treated of are those which are injurious to field and garden crops, to timber trees and fruit.

1. The first insect treated of in the reports for 1877-78 is one that is very familiar to us here :—

THE TURNIP FLEA-BEETLE

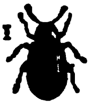

Fig. 21.

or 'fly' *(Haltica nemorum).* Figure 21 represents this insect magnified. During both years it seems to have caused much damage in many localities. "At Knebworth an example is given of the value of surrounding weeds to the farm insects as a means of support till the crops are ready for attack, in the appearance of the turnip-fly first on charlock (mustard) in fields where turnips had grown the previous year, and then causing great injury to the kohl-rabi and turnips"—an argument for clean farming. The following is a curious "remedy":—"The plan followed is to drive a large flock of sheep on the attacked field early in the morning, whilst the dew is still on the leaf, and, with the help of a dog, to keep them in constant motion, and well up in a body, so as to tread over all the field in turn. Treated in this way no injury is done to the crop; but if much ground has to be gone over, it should be taken on different days, as it would injure the sheep to keep them long without food, or to harass them by the continued driving early in the morning. In this case the extent of ground was 37 acres, and from four hundred to five hundred sheep were put on. The fly at the end of June was so strong as to threaten clearing the crop, and it had almost been decided to plough it up; but this treatment, which embodies disturbing and killing many of the insects by the treading, and which also makes the leaves distasteful for oviposition, both by rubbing of the sheep and the coat of dust scattered in dry weather, saved the plants and was followed by a good crop." Another and simpler remedy for use on a small scale is "sprinkling the young turnips with road dust, which preserved them entirely from injury." An observer states that "where the weather was highly favourable during the sowing season of May and June for a quick and healthy growth, the plants were thus run past the stage at which 'the fly' attacks them, and less injury was inflicted than had been observed for many years. He draws attention to anything that promotes healthy, rapid growth, till the young plant is well into the rough leaf, being the best preventive of the fly, and that, could the remedy be applied, probably heavy waterings in the evening in dry weather might be of service, and notes, in the shape of special applications, caustic lime, soot, and guano, which have each their advocates, applied in the morning when the dew is still on the plant, or gas-water applied in the evening, and also benefit from the use of a small quantity of salt."

Another observer notices that where the fly was particularly destructive the previous year there charlock (mustard) was prevalent. "This weed is common throughout the country, more or less plentiful according to agricultural care, some fields being comparatively free, showing where one farm ends and another begins." [These remarks might be made of several parts of Ontario, especially of the counties of Northumberland and Durham.] He draws attention to the benefit of eradicating the food-plant of the fly during the years when the land is unoccupied by turnips, and thus preventing, or in some degree checking, its annual multiplication.

From all the observations there is noticed "the advantage of a rapid, vigorous growth in resisting the attack of the fly, whether brought about naturally by plentiful rain, or artificially by manure containing the superphosphates or other chemical constituents required, and a word may be added as to the physical effects of rain and dew on the insect. A single drop is enough to clog the legs temporarily, and put an end to its leaping powers for the time being."

2. THE ONION FLY (*Anthomyia ceparum*)

is an insect that has found its way across the Atlantic and shown itself very destructive at times in the Eastern States and elsewhere on this continent; the following extracts may therefore be of use as well as interest. (In figure 22, we have this insect represented in both the larval and perfect forms.) "The eggs of the fly were first observed on the 21st of May, laid where the leaves divide, the larvæ hatching after a few days, and feeding on the seed-blade till they reached the root, then striking into the bulb, if formed, otherwise into the root, and soon destroying the plant. The soil was mostly light, and in high cultivation, and pulverized gas-lime scattered amongst the onions was found to act well in keeping off the insects. Watering the onions with the liquid from pig-sties, run into a tank specially arranged for the purpose, was found to answer still better. Several who adopted this plan secured good crops, whilst in the cases where it had not been followed the crops were for the most part destroyed." Another observer mentions that "he finds deep cultivation in autumn, with a good manuring and sowing in drills on a firm, well-trodden surface in spring, to be the surest means of securing a good crop free from attacks of the maggot." Miss Ormerod mentions that she "tried sowing two kinds of onions in rows along a bed of which half had been prepared in the usual way with farm-yard manure, and half deeply trenched with no manure added. Both kinds of onions on the manured ground did fairly and were uninjured, but on the unmanured ground the plants made no way, and were attacked by the maggot."

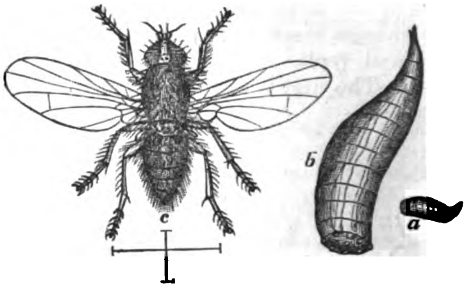

Fig. 22.

3. CABBAGE BUTTERFLIES (*Pieris brassicæ* and *rapæ*).

It is somewhat singular to notice that so little is said in the three Reports about our very familiar pest, *Pieris rapæ* (see figures 23 and 24), which has come to us from the "old country," while much attention is paid to its congener, *P. brassicæ*, a larger white butterfly which seems to be very destructive. In 1877 it was noticed that "the amount of appearance of cabbage butterflies varied much with the amount of shelter provided for the previous stage of pupation." Where cabbages were chiefly grown in fields few were found, but large numbers were observed to infest sheltered gardens. "A search under dry eaves, rough boardings or palings, and in the sheltered nooks which abound in garden ground, but are comparatively absent in open field cultivation, will at times bring scores and hundreds of pupæ to light, and serve to diminish the pest appreciably."

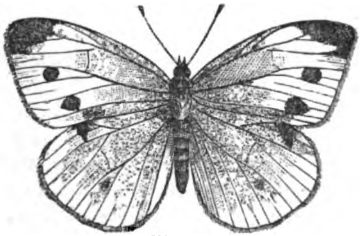
Fig. 23.

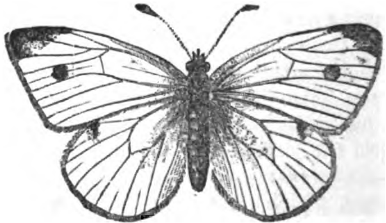
Fig. 24.

In 1879, at Dalkeith, *P. brassicæ* appeared in rather formidable numbers after the fine weather set in. The consequence was a severe attack of the caterpillar, especially in cottage gardens surrounded by weedy hedges and other harbours for insects, where the common cabbages, savoys, etc., were completely riddled by the vermin, and rendered totally unfit for human food. The best remedy is hand-picking the caterpillars, but this is tedious. A sprinkling of fine salt is very serviceable, carefully applied by turning up every leaf so that a small portion of the salt shall touch every grub. An application of finely-powdered lime in a caustic state, or even caustic soot, will get rid of the grubs, but both are objectionable with regard to the after use of the vegetables. *P. rapæ* was "moderately plentiful" last year in some localities, but apparently it was nowhere so numerous as it is with us over thousands of square miles.

4. Wire-Worms, or Click-Beetles (*Elateridæ*).

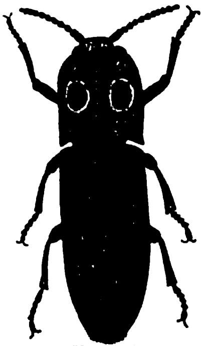

Fig. 25.

Figure 25 represents one of our commonest elaters, the eyed elater, *Alaus oculatus*. Several species are noticed as attacking various crops, especially barley. Among the remedies employed we may quote:—“A solution of carbonate of soda, in the proportion of about two ounces to sixteen quarts of water, applied three or more times from the beginning of May to the beginning of June is found a good way to clear the ground.” An observer notes “wire-worms in considerable numbers attacking barley sown after dead fallow. He drilled Lawes’ turnip manure with the bulk of the field, and on this the barley grew rapidly away from the wire-worm; whilst on two pieces, each seven feet wide, left across the field without the manure, more than half the plants were destroyed. This difference is noted as having been observed on previous occasions. Stirring the land well is considered the best remedy with root crops. Amongst corn (wheat) crops rolling with a heavy roller, or if possible, on the lighter soils with a clod-crusher, is the usual remedy. In one case the object is to solidify the surface and so stop the wire-worms working; in the other (the root and green crops) to stimulate growth in the young plants, besides disturbing the larvæ.”

In the last Report it is stated that the wire-worms did “much damage on some light-land farms, and the young barley after fallow, and where the land was in bad condition; but where the barley succeeded a good crop of roots, fed on the land by sheep, or where there was plenty of manure in the soil, the plants grew too vigorously to receive much injury. On heavy clay land the soil was so close that the wire-worm could hardly exist.”

5. The Wheat Midge (*Cecidomyia tritici*).

Our dreaded pest is the same insect as that here referred to as prevalent in England. See figure 26. In 1877 it was reported as unusually abundant in Hertfordshire and unusually absent in Essex. It is noteworthy that “in the latter county the chaff is used for cattle, whilst the custom prevailed in some parts of the west of England of throwing the chaff in heaps to decay, thus providing the maggot with good shelter during the winter to develop in the following June, and so infest the neighbourhood.”

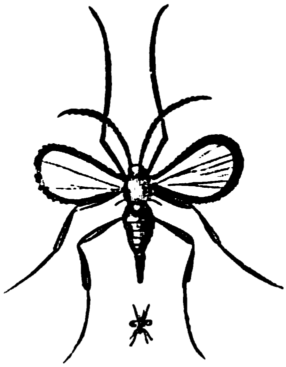

Fig. 26.

In 1878 it was again unusually abundant at the same place in Hertfordshire “in all the early wheat, many ears having from 10 to 15 kernels quite destroyed, besides others being deformed; the later crops were not so much affected.” The same year it was also abundant in parts of Devonshire. A writer relates that the wheat in his experimental field “stood up well at the time of cutting, but that just before blooming, portions were covered by small flies which deposited their eggs in the ear, and these developed into small orange-coloured maggots, which fed on the young grain. The unmanured crop came into ear some days later than the manured crops, and escaped injury from the fly, whereas the plot manured every year with fourteen tons of farm-yard dung suffered severely, and yielded only about two-thirds as much grain as in 1868, when the weight of straw was about the same as this year. It is, “of course,” he adds, “very difficult to estimate the damage done to a crop by the ravages of an insect, but that in the permanent wheat field undoubtedly suffered considerably from that cause. The yield of grain was not only much less than would be expected from the bulk of straw and its upright condition at the time of cutting, but also much less than would be judged from the amount of produce and proportion of grain to straw in the neighbouring field.”

In 1879 the same observer in Hertfordshire mentions that the midge "was abundant in all the earlier wheat fields, and did much damage, but little to the later crop; wheat ears did not make their appearance till about June 29th instead of June 12th, which may account for the date of the attack." Another observer, in the county of Norfolk, states that "a little patch of wheat, a quarter of an acre, sown in the autumn, suffered much from the wheat-midge; whilst another quarter of an acre close alongside, which, owing to wet and frost, was not sown till spring, was not injured by it." A third observer notices that "on June 27th the wheat-midge was especially abundant, whilst there were as yet no wheat ears in which it could lay its eggs, and that no damage took place from the ravages of the larvæ." The foregoing observations completely justify the remedies that I suggested for this pest in my account of the wheat-midge in the Report for 1871.

6. THE WHEAT APHIS *(Aphis Granaria)*

in 1879 attacked with extreme severity a field of 110 acres of wheat in Cheshire. (In figure 27 we have a representation of an aphis closely resembling the wheat aphis, highly magnified.) The observer mentions the aphides as first appearing in the early part of August and shortly afterwards they were not as observable; but about September 8th they were again noticeable in as great or greater numbers than before. The ears they had previously attacked had become perfectly white, as if blasted, and at the time of writing, September 16th, every green head in the field appeared full of them. It was estimated that what ought to have given four to five good quarters of wheat (about 30 to 40 bushels) would not yield more than ten to twelve bushels per acre, and that of very inferior quality." During the same year the aphis swarmed, in Yorkshire, both on wheat and barley, doing much injury.

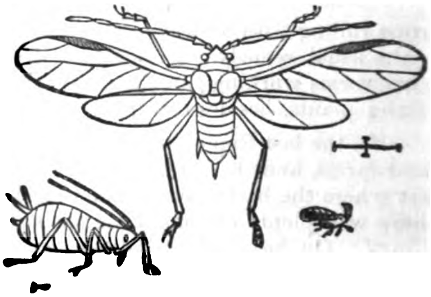

Fig. 27.

7. THE CRANE-FLY OR DADDY LONG-LEGS *(Tipula oleracea, etc.)*

is oftentimes a very destructive insect in England; several species are known in this country to commit much damage to grasses and crops. In 1878, near Dumfries, the larvæ of the crane-fly caused the worst insect attack of the season in the district. Hundreds of acres of corn (wheat) are mentioned as being completely destroyed. In 1879, at those spots in the same neighbourhood where it was so destructive in the previous year, it was scarcely noticeable, whilst in others in the same locality it was present to a most injurious extent. "According to report the worms had been counted at the rate of 12, and even up to 24, per square foot; and this insect is considered as without doubt the worst pest of the district." In Northumberland, Cheshire, Lancashire, and other localities, this insect was reported to be very injurious. The following account records an instance of a remarkably bad attack occurring in a fair-sized garden in the beginning of April, 1876. "The lawn was completely bared, and the larvæ were in such numbers that there was no difficulty in collecting them in barrowfuls; 57 larvæ were counted at one daisy root. Handpicking was useless, and a quantity of ducks were turned in, the soil being stirred into shallow furrows from time to time to allow them to reach their prey. Eventually the ravages ceased almost as suddenly as they had begun, but not until every piece of grass in the garden was bared, as if it had been cut with a turfing iron and left to die on the spot. Grass seeds were sown in the late spring, and their growth encouraged by a judicious use of nitrate of soda and dissolved bone manure. This soon restored the turf, and the *tipula* has hardly been noticeable since." "Looking at the partiality of *tipulæ* larvæ for damp ground, and that of the perfect crane-flies for rough neglected herbage, and their dislike to saline presence, it seems as if something might easily be done by draining, removal of lurking places, and dressing with chemical manures, at least to diminish this trouble, and the fondness of birds for the grubs shows a direct mode of destruction, whether by general encouragement of insectivora in the fields, or the more limited application available in the garden."

8. THE PEAR-TREE SLUG WORM *(Selandria cerasi)*

is a very familiar insect in Canada, (fig. 28); though I cannot say that our species is identical with that found in England, *Eriocampa adumbrata*, it is at any rate very similar to it, both in appearance and habits. In 1878 this insect did much damage in the district round Dalkeith. "The easily applied remedies of a dusting of caustic lime, or a heavy syringing of the tree with strong soapsuds, are generally very effective in getting rid of this pest." A full account of this insect is given by Mr. Saunders in our Report for 1874.

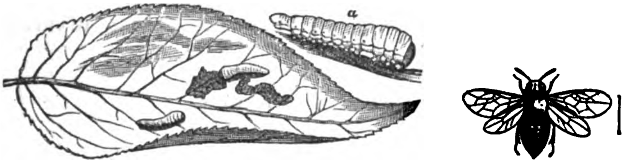

Fig. 28.

9. THE GOOSEBERRY OR CURRANT SAW-FLY *(Nematus ribesii)*,

our well-known pest (fig. 29), is recorded as being very prevalent, both in 1878 and 1879. In this country we are able to keep it in check by the use of powdered white hellebore, and I have never heard of any ill effects being produced by the employment of this poison. A writer, however, relates that on one occasion "I dusted my bushes with white powdered hellebore, and ten days after (being dry weather from the time they were dusted) a tart was prepared of berries from these bushes. After partaking of the tart we all got seriously ill, but recovered, and next day we were all right. Since that period I never again made use of hellebore for destroying caterpillars on berry bushes. The remedy I have used ever since instead of hellebore, with equal success, is flour of sulphur. It is easily applied by dusting it over the bushes with a pepperbox while they are under the morning dew; or, if during dry weather, the bushes ought to be watered and then dusted. It is only necessary to dust the lower part of the bushes if taken in time. The use of sulphur is perfectly safe, and berries may be used at any time after its application."

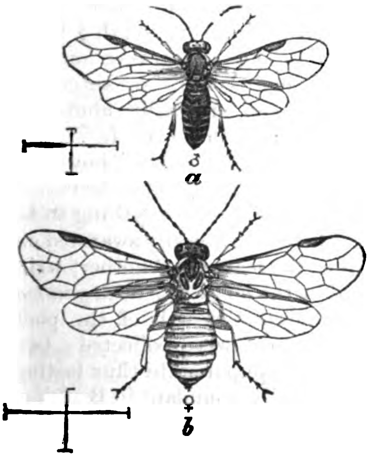

Figure 29.

10. THE ASPARAGUS BEETLE *(Crioceris asparagi)*

is an insect that has come over from England, and become very destructive on Long Island and in other parts of the State of New York. In fig. 30, this insect is shown in in its various stages. It is quite common, apparently, throughout England. The following remedies are set forth: —"The mixture consists of half a pound of soft-soap, quarter of a pound of flour of sulphur, and about the same quantity of soot, well mixed together in a pail of warm water. In this the infested shoots were dipped; and on inspection the next day it was found to have cleared the larvæ. The plants

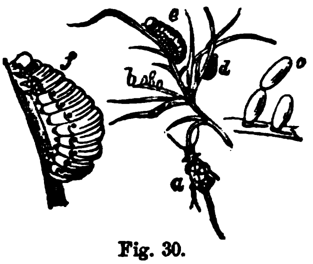

Fig. 30.

were syringed afterwards with warm water (merely to clear off the dirt left by the dipping), and soon resumed a healthy appearance, and were thus saved from an unusually severe attack; the *Crioceris*, when brought under treatment, being present on almost all the plants and stems, and noticeable by thousands in the larval stage, as well as in the egg." Another writer states: "I stopped what was becoming a destructive attack by syringing the plants with warm water, just bearable to the hand; this sent off the larvæ, or loosened them so as to fall to a shake; and throwing soot liberally through the damp shoots to the ground destroyed the fallen grubs. This treatment, repeated once or twice in the course of the season, completely saved the plants, and the soot gave a luxuriant and healthy growth."

11. INSECT MIGRATIONS.

The following account of an extraordinary migration of insects is so interesting that I need make no excuse for transcribing it here: "The swarm appears to have been composed, at most of the successive points noted, of the moth *Plusia gamma*, and of the painted lady butterfly, *Vanessa cardui.* It appears to have started from the north-west of Africa, and travelled in a north-east direction, was observed at Algiers about April 15th to 20th, 1879; it reached Valencia, and was spread over Spain, and also present in the Balearic Isles from April 26th to May 3rd, and crossed the Eastern Pyrenees on May 26th and 27th. It next appeared in the south-east of France, Switzerland and Northern Italy; and on the morning of June 5th, thousands of living specimens were found on the snow at the Hospice of St. Gothard. It was then distributed over Germany and Austria at dates of appearance noted as being from June 7th to 16th. Another column crossed the Mediterranean to Sicily, and spread northwards over Italy in June. The more westerly end of the migratory swarm reached Strasburg from June 3rd to 9th; Paris and its environs were apparently not reached till June 15th. The appearance on the south coast of England was noticed on June 10th; and the moths were subsequently observable throughout the three kingdoms. *Plusia gamma* was unusually abundant near Norwich on June 12th and 13th; and it was also noticed on the 13th in Essex. Subsequently it occurred in enormous quantities at many localities, the numbers, however, diminishing (as far as appears from the observations sent in) as the points of observation became more northerly. At Exeter, an observer states that he never saw anything to be compared with its numbers; towards the end of September the larvæ literally swarmed on every garden plant, defoliating the plants, as well as riddling the leaves. Another, writing from Chichester, mentions that serious injury was caused by the larvæ of *Plusia gamma* to the field peas, whole fields being stripped of their leaves, and the growth of the pods consequently checked. On August 5th great numbers of the larvæ were collected; two days later they spun up, the moths developing on the 14th, the pupal state thus lasting only a week or ten days. The moth was also noticed as unusually abundant in Buckinghamshire, Hampshire, Kent and in various other counties. "Before the appearance of the moth and caterpillar—it is noted—the sugar-beet crops in Saxony were in excellent condition, and would in ordinary circumstances have yielded a harvest of from nine to ten tons per acre; the actual yield where the caterpillars had been was only three tons."

A great many other insects are, of course, referred to in these interesting Reports, but the foregoing have been selected for notice here, inasmuch as they are more or less familiar to us on this side of the Atlantic. It would be an immense help to the effective study of practical entomology, and consequently of great value to the agriculturists and fruit growers of this country, if some similar plan could be carried out here. There would require to be one or more willing and competent observers in each county of the Province, who should note down particulars respecting a certain number of noxious insects, and send in their reports to some central office at the close of the season, making mention especially of any unusual depredations that might have occurred in their neighbourhood. By some such system as this we should get a large quantity of information that could easily be digested and put in proper shape for annual publication.

RHYNCHOPHORA—WEEVILS.

W. Hague Harrington, Ottawa.

The weevils are beetles belonging to that division of the *Coleoptera* known as *Tetramera* in the classification of early authors, and so distinguished because the beetles included in it have apparently only three-jointed tarsi or feet; the penultimate joint being so small and so closely connected to the preceding one as to be invisible without a magnifying glass. The greater number of these beetles can be readily separated from those of other families by their snouts or beaks, which in many species are so elongated and attenuated as to give their bearers somewhat of the appearance of lilliputian six-legged elephants. (See figure 31, which represents the apple curculio, *Anthonomus quadrigibbus.*) This well marked feature in their structure has gained for them their common name of "snout-beetles," and their scientific appellation of *Rhynchophora*, derived from the Greek, and signifying "beak-bearing." If we carefully examine one of these insects we will see that the head is lengthened into a proboscis, at the end of which are situated the mouth-parts, so reduced in size as to be almost invisible to the naked eye.

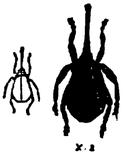

Fig. 31.

On the sides of the rostrum (to use the scientific name for this proboscis) are set the antennæ, usually slender and long; sharply geniculated or elbowed in many species, and commonly knobbed. They can be folded back so closely against the base of the snout, which is often grooved to contain them, as to be quite hidden. The beetles have hard, rounded bodies; some love the sunshine, others lie hidden all day and when night falls creep forth from their hiding places to continue their depredations, or fly about in search of new fields. The legs are often short and not well fitted for rapid progress, or for digging. Many have ample wings to carry them about, but in some species these useful appendages are wanting, or are so short as to be useless as organs of flight.

So far as known to me *all* the snout-beetles are vegetable feeders, and the great majority of them may be styled "obnoxious insects"; many being veritable pests to agriculturists and arboriculturists. They attack trees and plants of every kind and in every part; roots, stems, bark, twigs, pith, leaves, buds, flowers, fruits and seeds are all subject to the depredations of these long-headed foes, which, though minute, exist in such countless numbers as to make the total loss inflicted by them severely felt.

Weevils when young are short, fleshy, whitish grubs, without legs, and effecting what slight progress they require by the aid of their hunched segments, by the shape of which they may be easily known from the maggots of flies. Their heads are scaly or horny, and furnished with sharp mandibles to nibble the hard substances in which so many of them dwell, and in which they thus construct cells or short burrows. In these cells the majority of species pass also the pupa state, emerging only as fully developed beetles to spend a brief existence in the outer world. It is in the grub state that the weevil commits its depredations, for then it is invariably concealed in that part of the plant on which it subsists, secure despite its utter helplessness, and finding its proper nutriment in the walls of its prison. Trees are stunted and warped by having their young shoots devoured; fruit and nuts are caused to drop prematurely and decay; rice, corn, wheat and other cereals become mere empty husks, while peas, beans, and a great variety of seeds are destroyed by enemies so tiny that the hollowed shells form the house in which the full grown larva transforms to a perfect insect.

Our own weevils are inconspicuous both in size and colouring; in fact nearly all of them are small and dull looking beetles. In tropical countries, however, snout-beetles are found of very formidable dimensions, and some are most brilliantly marked and painted; of these I will mention a few examples presently.

The *Rhynchophora* are divided into two families, the *Bruchidæ* and the *Curculionidæ* (which unwieldy family has recently been subdivided into several smaller ones, but the purposes of this paper will be equally as well served by adhering to the former classification). The great bulk of the weevils are included in the latter family, only some three hundred species of *Bruchidæ* being known, about fifty of which inhabit America north of Mexico. They derive their name on account of their nibbling or "biting" propensities. Their depredations are chiefly confined to the various members of the *Leguminosæ*—pod-bearing plants—and are marked among peas, beans and many seeds which among foreign nations and tribes are important articles of food or export. Figure 32 represents the well-known pea weevil (*Bruchus pisi*), both larva and beetle, magnified and of natural size, and figure 33 the American bean weevil (*Bruchus fabæ*).

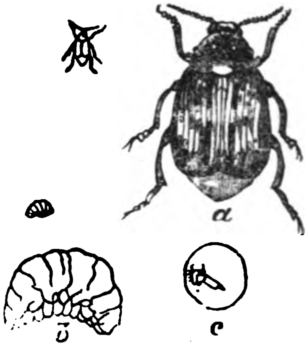

Fig. 32.

They are small active beetles, short and stout, of which the too-familiar pea-weevil is a good example, and are recognized by the manner in which the head is folded against the breast. The eleven-jointed antennæ are short and inserted close to the eyes. Some foreign species attain considerable size, one Australian fruit-eating species being considerably larger than our biggest weevil.

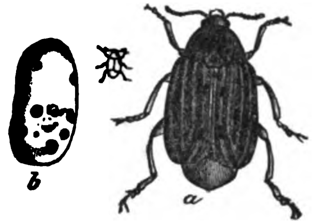

Fig. 33.

It seems almost superfluous to give any account of our pea-weevil (*Bruchus pisi*) after the able account of it by Mr. Saunders in the Annual Report for 1879, but as it is typical in structure and habits of this family I shall devote a few lines to it. Apparently a native of North America, it long since reached the southern portions of Europe, and is mentioned as having been so numerous in some districts of France in 1780 as to have seriously affected the health of the peasants who had partaken freely of the worm-infested peas. Mr. Curtis, in his admirable treatise on Farm Insects, written twenty years ago, expresses the hope that the climate of Great Britain will not suit the economy of this pest, and states that he has frequently found the beetles in imported peas.

The beetle is nearly oval in shape; from two to two and one-half lines in length and dull in colour, being black when divested of the dense covering of short hairs with which it is clothed. These hairs are rusty brown above and gray beneath, while the elytra (wing-covers) are marked by several white dots. The weevils pair in early summer when the pea-fields are in bloom, and as soon as the young pods are developed the female deposits her eggs thereon. A few days later the larvæ are hatched and eat their way into the nearest pea, in which they live usually until the next spring, when, having undergone all their changes, they come forth ready to attack the new crop. A method recently given by a correspondent of the *American Entomologist* to destroy the weevils in seed-peas is to immerse the latter for a few minutes before planting in a mixture of kerosene and water, which is said to effectually destroy the insects without injury to the peas. The following paragraph which appeared in a recent issue of the *Daily Globe*, contains a valuable suggestion as to the treatment of seed peas :—

"An entomological occurrence in THE GLOBE office suggests an easy method of annihilating the pea weevil—an insect whose ravages are rapidly driving the farmers of some parts of Ontario to abandon pea culture in despair. A note in this column, a few weeks ago, about a new pea pest (not the weevil) brought half a dozen consignments of 'buggy peas' with requests that the senders be informed whether their's was the new pest or the old one. The boxes containing the peas—which were all infested with the common weevil *Bruchus pisi*—were placed in a room which is somewhat over-supplied with steam pipes, and in which the temperature occasionally rises above 90 degrees. After a day or two in this room the regular transformation of the beetles from the pupa to the perfect state took place. On opening the boxes, they were found alive with weevils which had abandoned the holes in the peas, and were looking around for young pea pods in which to lay their eggs. In this lies the lesson. It is a pretty well settled fact in entomology that the function of egg-laying is not a voluntary one on the part of the female insect. Given the requisite temperature, and the process of egg-laying must go on whether the eggs be fertilized or not, or whether there be a proper place on which to lay them or not. It follows, almost to a certainty, that the pea weevil can be annihilated in a very simple manner. In the natural state the eggs of the weevil are laid on the outside of the young pea pods. The larva hatch out and burrow through the pods into the peas, one larva to each pea. Once there, they feed till they have attained their full growth, when they go into the pupa or chrysalis state. In the latter state they remain all the fall and winter. In the spring the weevilly peas are sown with the insect still in the pupa state. It remains underground till the soil has become warm, and then it changes to the perfect state, comes forth, and proceeds to perpetuate the species as before. Now, it appears from what happened to our consignments of pea bugs that the insects can be easily inveigled out of their holes during the winter when there are no green pea-pods for them to lay upon. Once out of the pupa state, it cannot go back again. If, then, farmers will during the winter place their seed peas in a warm room for a few days, the weevils may be brought out of their holes and killed, or left to die."

Bruchidæ from their habits are insects very liable to be carried from one country to another in the seeds used alike for food by man and weevil, and if the climate and food found in their new quarters be at all favourable, they quickly make themselves at home therein. As an example of the way in which such insects are imported it may be mentioned, that eight species were collected among foreign exhibits at the Centennial Exhibition.

The second division of the weevils is an enormous one, containing many hundred genera and many thousand species—the number of the latter named and described being 10,000 or more—while the list is being lengthened continually by the discovery of new ones, of which there must remain a great number, for a large proportion of the species are so small and inconspicuous as easily to escape early collectors in countries where many larger and more brilliant coleoptera can be easily obtained.

According to a recent "Check list of the Coleoptera of America north of Mexico," there are over eight hundred species, of which nearly half have been added within the last seven years. In Great Britain, where numerous collectors have thoroughly worked the ground, about five hundred species are known, and undoubtedly, when our own country has been more exhaustively searched, the Canadian list now numbering but little over one hundred forms, will be enormously swollen. I have obtained in the vicinity of this city over fifty kinds, some of which occur in large numbers.

Our snout-beetles are all small, many very minute; the largest is scarcely an inch long, while many are but one-twentieth of an inch. If then we consider the damage inflicted in this country, we can form some idea of the ravages that are wrought in more tropical countries where the weevils attain to a great size; compared to these our largest species are as sparrows to turkeys.

In Java is found an enormous black weevil, called *Protocerus colossus*, which measures three inches in length and is stout in proportion. With its immense front legs and strong, knobbed snout, it is a formidable looking beetle, and must do great harm to the trees on which it feeds. An allied Brazilian species is called *Rhina barbicornis* from its long hairy snout, which gives it a very fierce look. Some foreign weevils are as remarkable for their varied and brilliant colouring as for their size. The most commonly known is perhaps the diamond beetle of Brazil *(Entimus imperialis)* often used as a breast pin or similar ornament. It is a black insect, closely lined with rows of glittering geeen dots, and presents in its perfect state a magnificent appearance. A near relative of this beetle is *E.*

splendidus, clad in black bossed armour adorned with gold and green. A third species of these Brazilian gems—*Rhigus schuppellii*—wears a coat of green mail studded with golden knobs. Many other strangely formed or ornamented weevils are found in the south, of which but two examples can be given. The first is a large black beetle found in New Holland named *Gagatophorus Schonherri*. "There is scarcely any portion of the upper surface of this insect, which is quite smooth, those parts which are not knobbed being grooved. The upper part of the head has a wide and rather deep groove. The thorax is rounded and covered with knobs, which are comparatively scanty on the disc, but become very numerous and crowded on the sides. These projections are without any apparent order, but those of the elytra are arranged in three distinct rows. The elytra are very large and are turned over the sides rather abruptly. On the edge, where they are folded, is a row of nine knobs, so long and pointed that they may well be called spikes. Next comes a row of seven knobs, and next to the suture is a third row of four knobs, these last being placed rather irregularly (Wood's "Insects Abroad"). *Xenocerus lineatus* might well be mistaken for a longicorn beetle, so extraordinarily long are the antennæ of the male. The beetle is of a chocolate brown colour, marked with white lines, and is hardly an inch long, while its antennæ are more than two inches in length and very delicate.

Among our native weevils are two species belonging to the *Attelabidæ*. They are small beetles found upon the leaves of oak, etc., and are said to make a sort of little nest, in which to lay their eggs, by cutting and rolling up a portion of the leaf of some tree.

The largest weevil I know to be found in Canada is the one named *Ithycerus novaboracensis*. It is a stout-bodied beetle, from two to three-fourths of an inch in length; the largest ones (females) being one-fourth of an inch across the wing-covers. The snout is broad and the rather short club-tipped antennæ are inserted near the jaws. The thorax is short, about as wide as long, and marked by three longitudinal white lines. The elytra are wide and ample, being turned down well at the sides, and they are marked by parallel white lines, interrupted by slightly raised black spots. The colour of the beetle is black, but a scanty clothing of short white hairs gives it a grayish appearance. I have often found it during June upon beech trees, and the sexes copulate at this time. It is mentioned by Fitch as eating the buds and gnawing the twigs of apple trees in May and June.

Hylobius pales is one of the destructive weevils found upon our pine trees, and is very common throughout the lumbering districts. In Ottawa during the early summer they appear in great numbers, crawling on the sidewalks and on buildings and fences. Its length is about three-eighths of an inch, and its colour a deep brown, approaching almost to black. The rounded thorax is closely punctured, and the elytra have rows of impressed dots as if stitched, and also slight irregular markings made by white hairs, which in many specimens are rubbed off. The long snout is stout and strong, as are the legs, with which the beetle can cling tightly to its captor's finger, as it has a habit of doing, pressing at the same time with its snout, of which the mandibles are too small to pierce the skin. During May and June the beetle lays its eggs in holes bored in the bark of pine trees, and the grubs burrow between the wood and bark, loosening the latter and thus causing decay. I have found this beetle, early in May, with its snout buried in the base of the tube of the Mayflower *(Epigea repens)* in the same manner as bees perforate flowers to gather honey and pollen.

H. stupidus is a larger and heavier beetle, nearly half an inch long. The scutel is yellow, and there are scattered patches of hair of the same colour upon the body and wing-covers. It is much less numerous than the former species.

Pissodes strobi (fig. 35), the white-pine weevil, is smaller than the above described species, but is even more destructive in its habits. One of the most important uses to which our noble pines are adapted is for the construction of ships' masts and spars, for which purpose it is absolutely necessary that they be straight and faultless. Now, this weevil delights to select the leading or topmost shoot of the thrifty young pines, as the object of its attack. It bores holes in the bark, at irregular intervals, the whole length of the shoot; in each of these it lays an egg, and as soon as the larva is hatched, it eats downward toward the centre of the twig, and burrows in the pith. In the cell thus formed

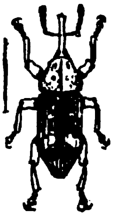

Fig. 35.

it undergoes the necessary transformations, and emerges the following spring as the perfect beetle. For a month or two after the eggs are deposited, the growth of the shoot is unaffected, but as the grubs increase in size, and reach the centre, it begins to wilt and shortly dies and withers. One of the lateral or side shoots, curves upward frequently, and takes the place of the destroyed leader, but a crook is thus caused which greatly lessens the value of the tree. The only way to prevent their ravages, is by cutting off all the dead shoots, while the insects are still in them, and burning them. When these beetles are very numerous they also attack the side shoots.

There are other species of this genus, very similar in appearance to *P. strobi*, which are found assisting it in its ravages, and which are sometimes abundant.

Another weevil found upon pines, from the middle of May to the middle of June is *Polydrosus elegans*, which, as its name denotes, is a very graceful and beautiful beetle. It differs from the preceding species in shape, its body being narrow and more cylindrical, while the head is not prolonged into a slender snout, but is lengthened only slightly, and flattened, the mouth being wide, and having inserted near its sides the antennæ. The colour varies from a silvery gray to a creamy buff, and I have several specimens, usually males, of a most delicate glistening green. Their colouring is caused, not as in preceding species, by a covering of short hairs, but by a coating of minute iridescent scales, resembling in shape grains of rice. When denuded of these fragile scales, which are easily rubbed off, the beetle is jet black.

The numbers of the genus *Anthonomus* are, as indicated by the name, "flower-dwellers," and are found upon trees or plants when in blossom, and as the fruit is setting. Several species occur in Canada, one of which, *A. quadrigibbus* (see fig 31), is a small, rough, robust beetle of a reddish brown, with a slender beak almost as long as its body. It is often abundant upon the hawthorn, and when disturbed folds its legs, tucks carefully away its antennæ, and looking for all the world like a withered bud, drops to the ground. This habit of simulating death and of taking on the appearance of a dried bud, seed, or bit of moss or dirt, is common to many weevils. The little beetle in question is sometimes called the apple weevil, because it punctures that fruit at times, with from one to twenty holes.

An allied species, *A. suturalis*, the cranberry weevil, is a minute reddish weevil, which in the United States attacks the cranberry vines, and, as it is found in Canada, may probably do so here also, although I have seen no record of its operations. The female is said to bore a hole in a bud, and after depositing an egg therein, cut it off, so that it falls upon the ground and decays, while the grub grows and transforms within it.

Conotrachelus nenuphar, the plum weevil, is too well known (especially after the full account of it by Mr. Gott, in last year's Report), to require more than a brief mention here. In fig. 36 we have this insect shown in its several stages of larva, chrysalis and beetle. From its extended ravages, and the crescent-shaped mark which it makes when depositing its egg in the young plum, it has been, not inappropriately, named the "little Turk." The grub, when hatched, eats towards the germ of the fruit, which then dies and falls prematurely to the earth, where it is kept moist while the worm attains its full growth. When arrived at maturity, the grub leaves its wasted larder, to pupate in the earth, from which it emerges the following spring, as a small, rough, dark, mottled beetle. Jarring the trees once or twice daily, during the season when the beetles are depositing their eggs (that is when the plums have reached the size of peas), and thus causing them to fall down upon sheets spread beneath the trees, is apparently the best method of exterminating this pest, which is spreading rapidly throughout the country, and destroying great quantities of fruit. Various other plans are however advocated, for the best of which I will refer you to Mr. Gott's report.

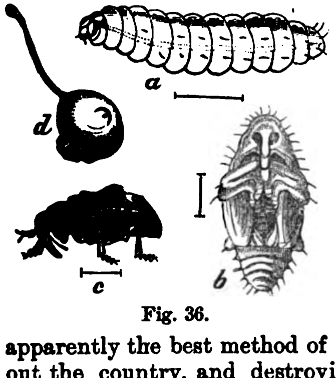

Fig. 36.

The plum weevil when abundant also attacks other fruit; including apples, pears, peaches, apricots, nectarines and quinces in its list of dainties. It causes some to fall prematurely, and mutilates and scars many others, so as to render them unfit for market.

Plums are not largely grown in this vicinity, but at several places in the woods where trees are growing wild (in abandoned clearings, etc.), I have found this beetle, and in such places it is left to increase unmolested, and is secured against extermination.

The plum weevil has been accused of causing the disease on trees, known as "black knot," but although the grubs are sometimes found in these excresences, they are not the cause of the injury, but only an accidental result of it, the beetle having been deceived into depositing its eggs in the swelling part when green and soft. Farther south, where the beetle is double-brooded, it has been said to deposit its eggs in the bark of young pear limbs, the grubs which winter therein accounting for the spring brood. The plum-gouger, *Anthonomus prunicidae* (fig. 37), is also destructive to plums.

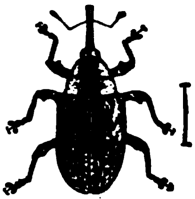

Fig. 37.

There are other species of this genus found in Canada, but none are so notorious.

Tyloderma fragariæ is a small weevil that (across the line if not in this country) attacks the strawberry, and is known as the "strawberry-crown borer," because it destroys the embryo fruit stalks and leaves in the crown of the plant. (See fig. 38, where the larva and beetle are both shown.) An insect with such a disposition may readily become a serious enemy to small-fruit growers.

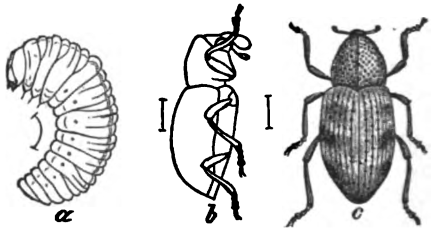

Fig. 38.

Mononychus vulpeculus is a robust beetle slightly larger than the pea weevil, but differing from it in shape. The body is about as wide as long and very thick; the thorax is much narrower, while the head is small and the snout long and fine. The beetle is black above, and of a rusty yellow beneath. The grub lives in the pods of the common flag, or iris, eating through two or three seeds (which it leaves mere rings) and forming a cell in which it undergoes its changes. They are often very plentiful and scarcely a pod escapes, but, of course, the greater part of the seeds in the pod are uninjured. On the first of August last, in passing through a field of these plants, I noticed that some pods had an appearance of some internal disease, and on investigation found the source of trouble to be a small white grub, evidently a curculio larva. Aware that a weevil did infest these plants, and not having hitherto bred any specimens, I carried away a pocketful of pods for the purpose of so doing. These were placed in a small box, and not looked at again until the 19th of September, when on emptying the box I found nine specimens of *M. vulpeculus*. There were also two small moths and six ichneumon flies, four of the latter being females and two males. On opening the pods I obtained nineteen more weevils and four ichneumons, as well as two larvæ of the moth. Hardly a pod was without a tenant, while in some dwelt two or three. A day or two later I visited the patch where I obtained the pods, and found that with few exceptions the pods had burst and scattered their contents, but a few remained, and either showed holes through which insects had escaped or still contained weevils or caterpillars. The beetles probably spend the winter underground or concealed in the dead plants.

As shown by the figures above given, fully twenty-five per cent. of the insects were destroyed by the ichneumons. In the same way the plum weevil has been greatly checked in some places by an ichneumon fly called *Sigalphus curculionis* (fig. 39), which is very similar in size and appearance to the ichneumon just mentioned as parasitic on the iris-weevil.

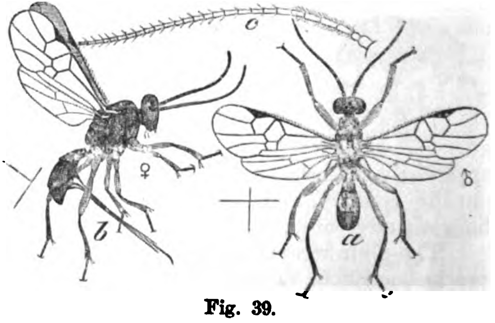

Fig. 39.

A weevil remarkable for its long slender rostrum or snout is found upon hazel-bushes in May, and more abundantly in June, about the middle of which month the beetles are frequently seen paired. It is called *Balaninus nascicus*, the specific name being conferred on account of its snout or "nose," which, though no thicker than a bristle, is nearly as long as the body, and carries a pair of long and very delicate antennæ. The beetle is a third of an inch long, with an oval body covered with short yellow hairs. The grub lives in the hazel-nut, but leaves it when full grown to transform in the ground. In 1879 the nut crop was large and these beetles were very abundant, but last summer there were but few nuts and I only observed one weevil. This beetle, according to Fitch, also feeds on hickory nuts, and *B. rectus*, distinguished by the beak being shorter and straighter, attacks acorns. This genus, I may add, derives its name—*Balaninus*—from a Greek word signifying acorn.

Remarkable as our nut weevil is for its long, slender nose, it is far surpassed by an African beetle which has a bristle-like snout fully three times as long as its body, the latter being half an inch in length.

Cratoparis lunatus is not an injurious weevil, for, unlike the majority of its kind, it forsakes sweet flowers and succulent fruits to feast upon dry fungus, such as grows upon old beech trees. It is about a third of an inch long and of a mottled colour, exactly resembling when disturbed a bit of fungus or moss.

The members of the small group *Brenthidæ* are easily distinguished from other weevils by their remarkably long bodies, snouts not bent downwards or curved, but stretched straight out in front, and unelbowed antennæ. The only Canadian species is *Arrhenodes Septentrionis* (Hbst.), the larva of which lives in hardwood trees (most frequently oak), not only in dead trees but in living ones. The female is said to bore a hole in the bark with her long snout, and shove into the puncture an egg. The cylindrical, whitish grub bores a round hole through the bark and into the solid wood of the tree. It is a slender worm, an inch or over in length, and little more than one-tenth in diameter; changing in its burrow to a yellowish white pupa.

The beetle has a cylindrical body attached to which is an egg-shaped thorax, rounded off where it is joined to the body, and tapering gradually to the head, which is prolonged in a straight snout, hardly as long as the thorax. The snout of the female is very slender, and the jaws at the tip are so small as to be barely visible to the naked eye; that of the male is much heavier, and the jaws are strong and curved. The antennæ of the female are inserted at the base of the rostrum near the eyes, while those of the other sex are set midway between the eyes and mouth. The general colour of this beetle is a rich brown; it is very smooth and glossy, with the exception of the wing-covers, which are striated, punctured and marked with irregular, broken, yellow lines. These beetles may be taken in June among oak trees, or more readily in lumber yards among newly sawn oak lumber. I have also taken several which were attracted with other species of weevils to a bright light placed to allure moths. They vary wonderfully in size, the males (an unusual thing with insects) being largest. Ordinary specimens are from four-eighths to five-eighths of an inch long and about one-eighth in diameter, but Fitch mentions one as being only two-eighths long, and I have an enormous male, a giant of his race, measuring over seven-eighths. It is proportionately stout; the rostrum is very broad and strong, and the jaws large and powerful. It was found last summer in a cleft of a newly fallen butternut tree.

The *Calandridæ* embrace many highly destructive insects. In the West Indies is found an enormous weevil which injures palm trees and sugar-canes. Its gigantic white grubs are called by the negroes "gru-gru," and by them, as well as by many white people, are considered a very great delicacy, although those not accustomed to such unusual dainties would consider them a very distasteful kind of grub.

Our northern species are small but still capable of doing immense damage by their united efforts, and the grain weevils have a world-wide notoriety on account of their ravages. Three species of the latter are common in the States, viz:—*Calandra oryzæ*, *C. granaria, and C. remote-punctata;* the two last are also found in Canada. *C. oryzæ*—the rice weevil—is supposed to have spread westward from the East Indies with the grain from which it derives its name. Unfortunately, however, it does not confine itself to rice, and at the Philadelphia Exhibition was found to abound in rice, maize, and wheat from all parts of the world.

With the aid of its relative the granary weevil (*C. granaria*)—see fig. 34—it destroys vast quantities of stored grain. Curtis says that no insects in England do more mischief to stored grain than these two weevils introduced from abroad. In warm countries, such as those of southern Europe, there are many broods during the year, and the loss caused is correspondingly great. The beetles penetrate some distance into the heap of grain; the female lays her eggs singly in the grains, and in a few months there remains nothing but a heap of empty husks, tenanted by grubs and beetles. At an entomological meeting in England, April 1870, it was stated that 74 tons of Spanish wheat when sifted yielded *over half a ton of weevils*, and 145 tons of American grain gave *one and three-quarter tons.* Fortunately these beetles do not thrive without heat, and cannot carry on their depredations in the cold of our winter, hence grain can be stored here for many months without loss.

The *Apionidæ* are a group of small pear-shaped weevils the minute larvæ of which infest different seeds.

Besides these we might mention as destructive the quince curculio (figure 40), *Conotrachelus cratægi*, which is injurious to quinces; the imbricated snout beetle, *Epicærus imbricatus* (figure 41), which injures apple and cherry trees by gnawing the twigs and fruit; the corn sphenophorus, *Sphenophorus zeæ* (figure 42), which damages the corn crop and the potato-stalk weevil, *Baridius trinotatus* (figure 43), which injures the potato.

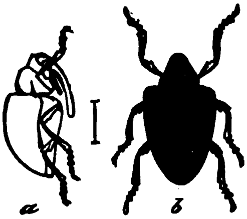

Fig. 40.

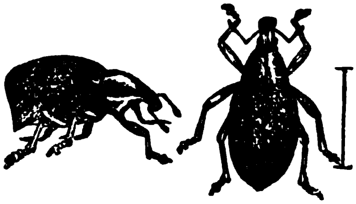

Fig. 41.

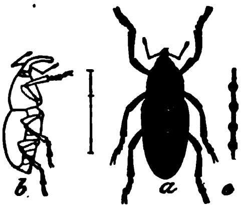

Fig. 42.

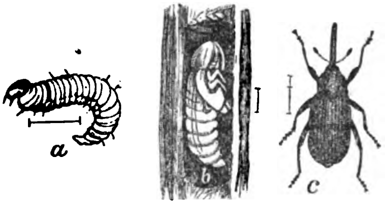

Fig. 43.

This paper has already reached such a length as to exclude further descriptions of our weevils, species of which will from time to time be found coming into notoriety through attacks on our trees or plants. Even those now only to be met with feeding on wild plants may some day transfer their affections to a cultivated one, as has frequently been the case hitherto. Occasionally also new species may be brought into the country with imported seeds and plants. The *American Entomologist* recently warned importers of fruit plants from England to be on their guard against introducing a weevil, which has of late years been very destructive to raspberry bushes, as it would, doubtless, flourish here, there being several closely allied species already in this country.

The name of this possible visitor and dreaded foe is *Otiorhynchus picipes*, and in its native land it attacks a great variety of plants and trees, such as peas, beans, turnips, elms, lime trees, etc. The principal damage appears to be done by the full-grown weevils, which are wingless and night feeders, hiding during the day in crevices or under bark, stones, etc. They are "sometimes a dreadful pest in gardens, committing sad ravages on vines in hot-houses and on wall fruit, during the night. They likewise injure raspberry plants in spring by eating through the flowering stems and leaves, and they nibble off the bark and eat out the buds of apple and pear trees." The larvæ live in the roots of flowers and other plants, and are very destructive to them.

The ravages of weevils cannot be stayed by the same measures which avail in the case of the potato beetle and other leaf-feeding larvæ. Their grubs cannot be reached by Paris green and similar poisons; their destruction can only be accomplished by that of the substance in which they feed concealed. Failing then to reach the grubs, it remains to attack the beetles themselves, and this is often difficult of accomplishment, on account of their secluded habits and the trouble of finding them. They are also exceedingly tough subjects to kill; their hard bodies are capable of resisting much hard usage, and, to a great extent, the action of such substances as are all-powerful in the destruction of insects endowed with less vitality.

I have frequently kept plum weevils for hours, sometimes for a couple of days, in a cyanide bottle, which would kill most insects in a few minutes, and although stupefied, they would, in a short time after liberation, be as lively as ever. They are indifferent to the most powerful and offensive odours, and decoctions of tobacco, soap and lime, that easily repel most insects, are apparently but little hurtful to them.

To show the tenacity of life in snout beetles, an English entomologist mentions a curculio (of genus *Cleonus*) which, after resisting the action of laurel leaves, which are used in collecting-bottles as poison, was twice immersed in benzine, the second time for a whole night, and finally had to be killed with hot water. Another instance is where some weevils lived in and devoured coriander seed, among which were pieces of caustic stone.

One simple way to prevent the ravages of weevils is to see that all seeds are thoroughly freed from them before planting, and likewise in setting out plants or trees to observe the same precautions. Yet, sooner or later, they will find their way from adjacent fields, or even distant counties, and then resort must be had to warlike measures. Some species, such as the plum weevil, may be jarred or shaken upon sheets, or frames covered with cotton; others may be taken (some by day, some by night) with sweeping or beating nets. The best way to kill the captured ones is to put them in boiling water.

Fruits or nuts, which have fallen to the ground, should be carefully collected and destroyed before the larvæ therein have left them and entered the earth, and all substances under which the beetles might hide should be removed.

Twigs and canes infested should be cut off and burned in the autumn, or in spring before the beetles have emerged.

Powdered pyrethrum will be found very effectual in destroying weevils among such seeds as peas and beans, if dusted over them, and if well sprinkled among heaps of grain is said to thoroughly kill off the grain weevils.

But little assistance is received from birds toward exterminating weevils. Many species are concealed all day in crevices, under stones, etc., or even beneath the surface of the ground, and only come forth when the birds have ended their labours. Others so closely simulate bits of moss or dirt, or the colour of the bark or other part of the plant on which they rest, as to be safe even from the sharp eyes of our feathered friends. Nearly all are so timid that when alarmed or disturbed they fold up their antennæ and legs and drop to the ground, where they are almost invisible. The stray weevils occasionally captured by birds are not very satisfying morsels, being chiefly hard, horny shell, while the grubs, which are soft and fat, are generally secure in their cells or burrows.

ON THE CHIEF BENEFITS DERIVED BY FARMERS AND HORTICULTURISTS FROM A KNOWLEDGE OF ENTOMOLOGY.

By James Fletcher, Ottawa, Ont.

"Well! what's the use of all your bug-catching and long names to me?" is a question which in this essentially utilitarian age the entomologist has too often to answer farmers and horticulturists even here in fair Canada, where the unparalleled climate presents most favourable conditions not only for the successful cultivation of roots, cereals, fruit and the other varied forms of produce which constitute the wealth of the agricultural classes, but also for those gigantic armies which from time to time levy such undue tribute upon their hard-earned savings, and where consequently it might be imagined they had been taught a practical answer by bitter experience. But no! such is not the case, and these "minims of creations" individually so puny and weak, but which, united, form such irresistible forces, are to-day very little more studied by the people most concerned than they were fifty years ago. The answer to the question is simply this, "To enable you to know your friends from your foes." I shall endeavour to show that everything which is generally designated by that expressive word "bug" is not an enemy which must be executed at once without a trial. It cannot but be a matter of considerable surprise to any person who turns his attention to the study of Entomology to find to what an extent, comparatively speaking, that branch of Natural Science is neglected by scientific men, for notwithstanding the large sums of money devoted yearly by wise governments towards its encouragement, and the untiring efforts made by individual students to present it to the masses in a popular form it must be acknowledged that as yet it is not studied nearly as much as it deserves.

Little attention was paid to Natural History previous to the commencement of the last century, although the writings of some of the leading philosophers of antiquity show that it was considered of sufficient importance to receive special study. Aristotle and Pliny the elder, wrote of insects largely, although, it is true, somewhat erroneously at times. They too often fell into that trap which is still set in the path of modern investigators, namely, allowing their imaginations to carry them away from the truth to build up a previously conceived theory. There are not many of whom it can be said as of Dr. Leidy, "the most distinguished naturalist of America," as follows:—"In the performance of his scientific work he has confined himself to the duty of accurately describing what he has seen. He very rarely draws inferences from his accumulated facts, and his innate truthfulness is such as to deter him from theorizing."*

The first book published in England upon insects alone is said to have been Mouffet's "Theatrum Insectorum," which appeared in the reign of Charles I, after having passed through the hands of five learned doctors, all of whom did something towards its completion, and after having taken about 100 years to finish. It was owing to the efforts of Ray and Linné, ably assisted by the their contemporaries Reaumer and DeGeer, that Entomology was raised to its proper place among the sciences. Since their time many learned men have fought hard to keep it there, until now "the laugh at Entomology is nearly spent, and known professors of the science may meet in open conclave to exchange observations without fear of becoming subjects for a commission *de lunatico inquirendo*, and may now, net in hand, chase their game without themselves being made game of."† This, however, was not the case in the last century, for we are told in Kirby and Spence's "Introduction to Entomology" that an attempt was made to set aside the will of a rational woman (Lady Glanville) on the ground of insanity, which was evinced, it was claimed, by her fondness for collecting insects.

Foremost of all the great powers in the prosecution of scientific research is undoubtedly the Government of the United States. No expense or trouble is deemed too much, but whatever advantage energy and perseverance can gain for the general good they secure. Their official publications upon scientific matters are simply magnificent, and the generosity with which they distribute them to institutions and societies, where they can be freely consulted, are as proverbial as the politeness of the gentlemen entrusted with the investigations which are thus recorded. No one ever need be at a loss for information upon any ordinary scientific point, for on writing to the Department in Washington which considers that matter, he will receive an answer by the return mail.

By means of the generous assistance of our own Government, our Entomological Society of Ontario is able to put in the hands of all the agriculturists of the Province information with which, at any rate it is hoped, they can fight most of the insect pests from which we occasionally suffer, and also at the same time learn to discriminate which among the countless hordes of the insect world may be ranked as allies.

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* Popular Science Monthly, vol. xvii., p. 691.
† Episodes of Insect Life.

The naturalist founds his studies upon the theory that nothing in nature is useless, and everything that is, must have some special function to perform or it would not exist; it is in tracing up these special adaptations to certain ends that he finds the charm which enables him to carry on the laborious investigations which are oftentimes necessary.

As every one knows, vegetable and animal life are the two re-agents which Nature employs to keep up the balance of creation, the one feeding upon or deriving its nutriment from the other. Now, these two agents are to a certain extent acted upon and kept in check by their own component parts. Whenever, owing to particularly favourable circumstances, too many seeds of any one species of plant spring up in the same place, they do not all mature, for if they did, all would be sickly from want of light and air, and the species would gradually degenerate. Consequently, it is provided that the weaker should be kept down and choked to death to make room for their more robust companions. This is similarly the case in the animal world, as for instance with insects. When, from special circumstances, any one species is abnormally multiplied, it is sure to be attacked and kept in check by some other kind, which itself may be a prey to another species. Plants through all their stages from the seed to the decaying leaf, are the original source of support to some form of animal life; wherever vegetable life is profuse, there insects abound. The green plant attracts innumerable small insects; these in their turn attract larger carnivorous species, which are again preyed upon by birds and reptiles, and the larger carnivorous animals follow. The flesh feeders, thus depending one upon the other for subsistence, have a primary dependence upon vegetable life; therefore, wherever there is the greatest variety of vegetable life there will necessarily be the greatest variety of animals, whether quadrupeds, birds, reptiles or insects.

It is estimated that insects comprise no less than four-fifths of the whole animal kingdom. While there are about 55,000 known species of animals, excluding insects, the number of these amounts to upwards of 200,000. It is therefore perfectly manifest that they must perform some very important mission in the economy of nature. "It would be easy," writes the Rev. J. G. Wood in "Insects Abroad," "to show how the very creatures which are most detested by man, and do him the most direct damage, are indeed, though indirectly, among his best benefactors. Apart from direct benefit or injury to man, the whole of the insect tribes are working towards one purpose, namely, the gradual development of the earth and its resources. The greater number are perpetually destroying that which is effete, in order to make way for something better; while others, whose business seems chiefly to be the killing and eating of their fellow-insects, act as a check to their inordinate increase, and so guard against the danger of their exceeding their proper mission."

I will borrow from the same author two more similes demonstrative of the fact that even amongst those insects which we consider most noxious we have some good friends. What more annoying creature can the mind conceive than the common mosquito? Truly is Beelzebub ("King of the Flies") rightly named if these are types of his subjects. It must be remembered, however, that devouring human beings is not the normal occupation of mosquitoes; but the former are intruders into their domains, and consequently must bear the consequences. Their real object is a beneficent one. In the deep dark forests of the tropics the air would be perfectly stagnant, and an enormous development of noisome fevers would be the consequence, if it were not for the motion caused by the wings of these minute creatures which breed there in myriads, and that of various birds and predacious insects which they attract there to feed upon them. In the larval state, too, they live in water, and feed upon the particles of decayed matter which are too small to be noticed by the larger aquatic animals. Were it not for the presence of these insects, which swarm in vast armies in all stagnant water in warm climates, thus purifying it as well as the atmosphere, such localities would be uninhabitable by any animals higher than reptiles. Again, strange as it may appear at first sight, if it were not for the existence of the many borers and wood-eating insects we could have none of those lovely forests which give so much beauty to our landscapes, and are the source of so much wealth to the country. Let us imagine that all these insects have been destroyed at one fell swoop, and note the consequence. A giant of the forest dies, and in course of time, during some winter storm, is blown down. Where it falls there it lies, and nothing can grow from the space which it covers. Time rolls on and tree after tree falls, until the whole ground is covered with the trunks and limbs of fallen trees, and what was once a stately forest, with all its wealth of life, is now a vast wilderness where nothing can grow. How different is the beneficent operation of Nature under the present conditions; Scarcely has a tree shown signs of declining vigour than the insect hosts are at work. First of all come certain species which pick out any weak point and deposit their eggs there. The larvæ in due time hatch, and, eating into the tree, accelerate its decay. When it dies and falls to the ground it is immediately pounced upon by the large wood-boring beetles, which deposit their eggs upon the bark; these hatch into grubs armed with strong jaws with which they soon bore into and through the trunk, thus rendering it permeable to air and moisture. Smaller beetles and other insects follow in the wake of the larger, and bore out the softened decaying wood, some using it as food, others as materials for their nests. The rapidity of the work of destruction is astonishing, and, in an incredibly short time, the giant which had taken hundreds of years to mature is reduced to mere dust, which serves as a fertilizer of the soil, and enables it to produce fresh trees to fill up the gap left by the one which has gone.

It is questionable whether any good results would follow from giving statistics of the amount of damage done by insects at different times, for so enormous are the figures that could they even be appreciated they would not be believed by those who do not make a study of the matter. It was estimated by Mr. B. D. Walsh, a careful observer, that in 1861 the injury caused by insects in the State of Illinois alone amounted to twenty million dollars, and that the damage done by insects in the United States cannot be less than three hundred million dollars annually.

It may not be out of place here, to say a few words with reference to scientific nomenclature. There appear very frequently in the different newspapers accounts of the depredations of insects, and, that these may be concise and explicit, it is absolutely necessary that some of the technical terms of Entomology should be used. But this is not pleasing to all the agricultural classes, "for," say they, "how do we know what such terms as hymenopterous, coleopterous, or dipterous, insects, which so frequently occur, mean?" True! as a rule they do not; but if they take an interest in their own affairs, they should make a point of finding out what they mean; no one suffers more from these hosts than they do, and it is ridiculous to think that they will remain inactive spectators when it is within their power to avert or at any rate to palliate the evil, by taking cognizance of and following the instructions given in the records of the work done by entomologists. And what does all they are asked to do amount to? Simply this, that they will learn the meaning of about at the most a score, certainly not more, of classical words. Now, let us consider what would be the result of their taking this trouble. In the first place Entomologists could write short and concise accounts, intelligible to all, and, much more important still, these accounts would not only be read and profited by, but the farmers, necessarily taking an interest in what touched them so nearly, would also communicate many of their own observations which, isolated, were useless, but being brought to the notice of one who made a methodical study of the life-histories of insects, might form a connecting link of the utmost importance in a previously broken chain of observation, on a certain insect. These observations, too, being properly expressed, could be relied on, and no confusion could arise which would decidedly not be the case unless the proper terms were employed. Curtis, in his "Farm Insects," expresses himself as follows: "It is a great mistake to suppose that scientific descriptions and correct nomenclature ought to be employed for the use of those only who are specially engaged in the study of Natural History. If insects be not thus accurately described, and their names learned carefully, the facts noticed by practical observers are generally worthless, and may tend to mislead, by the confusion of one species with another, and the consequent adoption of improper remedies. It is thus that I have found, in extensive reading on these subjects, that a very large amount of the information given by practical agriculturists and gardeners has proved valueless in cases where, if the particular species alluded to could only have been identified, it would have been of the greatest value in furthering subsequent investigations."

But why, it may be asked, use Latin and Greek, why not use English? Firstly, because English is not spoken in all parts of the globe, while Latin and Greek are the universal languages of the learned in all countries, and secondly, because the very nature of these languages particularly adapts them for the purpose. In Natural History it is frequently necessary to distinguish very different and very approximate forms, and it is of the greatest importance that the differences perceptible to the eye should be explained by precise terms in a concise and readily understood language, and Latin has been unanimously chosen by scientific men. When, however, as is occasionally the case, that tongue is deficient in a characteristic expression, the example of the early writers is followed and application is made to the Greek, which, from the euphony of its words and the fulness of its tones, is well adapted to the construction of permanent names of orders and genera.

There has been great difference of opinion among entomologists as to what orders in the animal world the class INSECTA should include, and perhaps even more upon the division of these orders into sub-orders. As Dr. Packard's "Guide to the Study of Insects" is the only manual we have here, it will be well to follow the plan there presented in drawing a short sketch of the class.

Insects are divided into three orders :—

1. Hexapoda,

or true insects, which have six legs, and attain the perfect state; in which they generally possess wings, through a series of stages of existence, or metamorphoses, known by the names of the egg, the larva or caterpillar, the pupa or chrysalis, and the imago or perfect insect. Upon examining the body of a perfect insect, it will be seen that the portions of the body are more distinctly separated than they were during its earlier stages, and that now the segments of the body are collected into three chief regions,—the head, the thorax, and the abdomen. It is from this division of the body that the word insect is derived. Aristotle called insects εντομα, from εντεμνειν = to *cut in*, and the Roman writers, following him, called them *insecta*, from *insecare*, which also means to *cut in*, and this name has been adopted by all later authors.

2. Arachnida,

or spiders, which have the segments of the body grouped into two regions, and have eight legs, but no wings; they pass through no metamorphoses, but grow by frequent moultings of the skin.

3. Myriapoda,

or centipedes, which have the body worm-like, without wings, and the segments not grouped into regions (except in the newly hatched young), have no metamorphoses, and grow by the development of additional rings to the body.

We will turn our attention to the first of these orders. The true insects are divided up into seven sub-orders, according to the structure of their wings, and these again are grouped together into two series, according to their relative rank and affinities. The first and higher series have the body usually cylindrical, mouth parts more generally formed for sucking, metamorphoses complete, larva usually cylindrical very unlike the adult. The sub-orders embraced by this series are Hymenoptera, Lepidoptera, and Diptera.

In fig. 44, we have a representative of the Hymenoptera in the common blue digger-wasp (*Chlorion cæruleum*). Fig. 45 shows one of our butterflies, *Papilio turnus*, a familiar species, belonging to the Lepidoptera, while the Diptera are illustrated by the red-tailed tachina fly (*Exorista leucaniæ*), fig. 46.

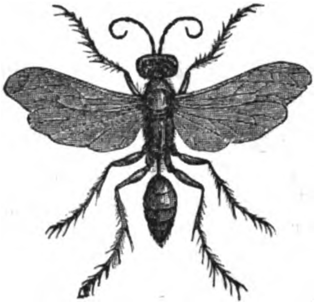

Fig. 44.

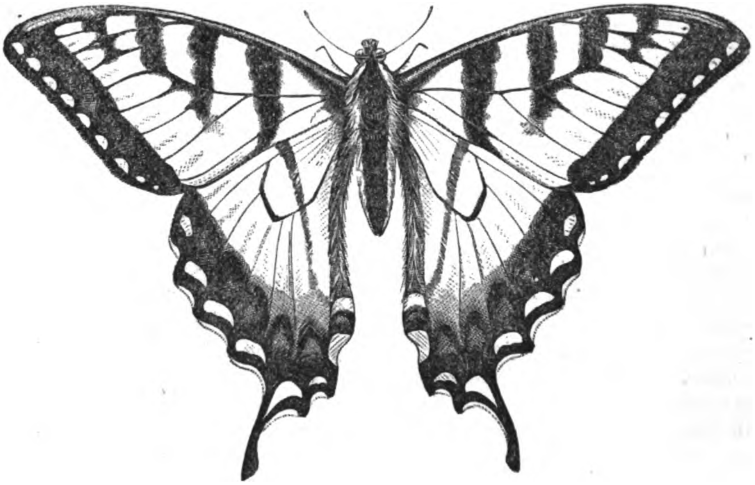

Fig. 45.

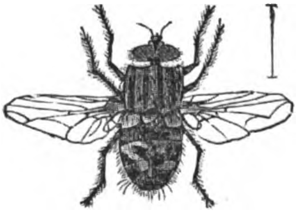

Fig. 46.

The second, and lower series, have, usually, the body flattened, mouth parts adapted for biting, metamorphoses complete, larva flattened and often resembling the adult, and comprises Coleoptera, Hemiptera, Orthoptera, and Neuroptera.

A familiar example of the Coleoptera is given in the Cylindrical Orthosoma (*Orthosoma*

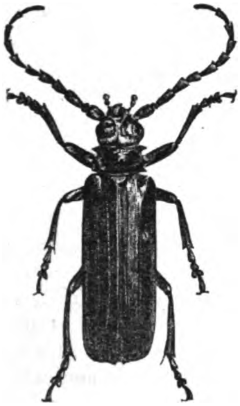

Fig. 47.

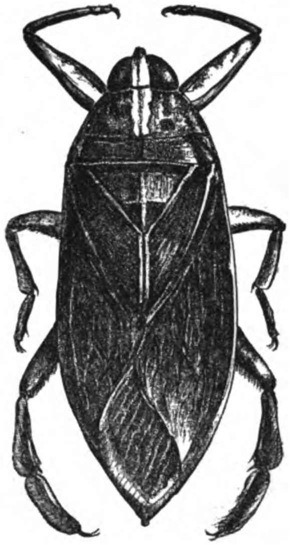

Fig. 48.

cylindricum), fig. 47, one of our most abundant longicorn beetles, the Hemiptera are

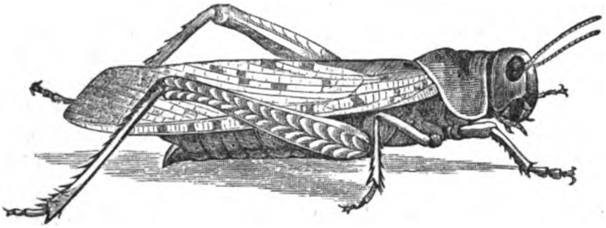

Fig. 49.

represented by a large water bug (*Belostoma grandis*), fig. 48; the Orthoptera, in fig. 49, by

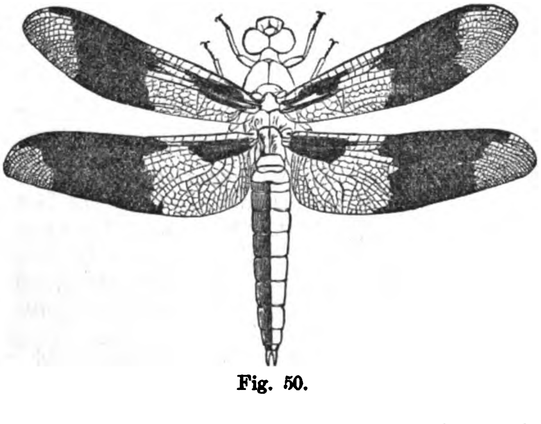

Fig. 50.

a common grasshopper, or locust; and the Neuroptera by a dragon-fly (*Libellula trimaculata*), fig. 50.

The three regions into which the segments of the six-legged insects are grouped, are known by the names of the head, the thorax and the abdomen. *The head* carries the special sense organs, as the eyes, the mouth and the antennæ. The eyes are wonderful structures, and are constructed to cover a very large field of vision; they consist, first of all, of two large compound eyes, made up of numerous small six-sided facettes, which are so numerous that Leeuwenhoec is said to have counted as many as 8000 in the eye of a fly, and Strauss 8820 in that of a cockroach; besides these two compound eyes, there are in many insects two or more simple eyes (*ocelli*) arranged across the forehead, they can be easily seen in the common Humble Bee. There are some insects which have only *ocelli* and even some with no eyes at all.

The principal organs of the mouth are six in number, two on each side of the opening, one above and one below, arranged thus : : :, the upper single organ is the upper lip or *labrum*, the lower the *labium* or lower lip, this lower lip has a basal joint (*mentum*) supporting a more flexible part (*ligula*); the upper or inner integument of the *ligula* is usually developed into a kind of tongue, which is a distinct part (*lingua*) in the locusts and dragon flies; the superior pair of the lateral organs are the upper jaws or mandibles, which are generally hard and serve to tear the food, the inferior pair are the lower jaws or maxillæ, which are generally soft and serve to to carry the food to the gullet, to be swallowed. To the lower jaws and under lip are attached short jointed processes, called *palpi* or feelers. These oral organs are the same in all insects, although the structure is vastly different among those which obtain their food by mastication and those which obtain it by suction; by dissection and comparative anatomy however it can be shown that they are identical, only greatly modified in form, in both of these classes. In biting insects, as beetles, the side pieces are short, far apart, and have a horizontal motion, and the upper lip is a flat plate closing the mouth above; with sucking insects as mosquitoes, the same parts are elongated into lancet-like organs, are close together, and have a longitudinal motion, and the lower lip at the same time is developed into a tube, which incloses them. In Lepidoptera the three upper organs are very feebly developed, while the maxillæ are elongated into a delicate proboscis, the identification of which with the maxillæ is shown by the occasional presence at its base of a pair of minute palpi; the lower lip is soldered to the head, but is furnished with a pair of palpi, well developed and clothed with scales, which act as a protection to the proboscis. In the flea the middle lancet seems to represent the upper lip.

In bees the lower lip and maxillæ form together a sucking apparatus, but they are also provided with well developed upper jaws or mandibles.

In the front part of the face of an insect are two appendages, which vary very much in form, in the different sub-orders and genera, and even in the sexes of one species; they are called antennæ. What the exact functions are of these important organs, is not known, but it is probable they have more uses than one. Experiments have been made with moths in which it was observed that if the antennæ were removed the insect seemed unable to direct its flight. It is probable too that the olfactory nerve is situated in the antennæ. The different forms which the antennæ take have been made use of by entomologists in classifying insects.

The next division of the body of an insect is the *thorax*. This is the solid portion which bears the organs of locomotion, and comprises the three segments which follow the head. The first one is called the pro-thorax and bears the first pair of legs, the next or middle segment is called the meso-thorax and supports the second pair of legs and the anterior pair of wings, the third segment is called the meta-thorax, and to it are attached the third pair of legs and the hind wings. The wings are objects of great beauty and strength, and consists as a rule of a double membranaceous plate, traversed by more or less bony veins.

The last division of an insect's body is the *abdomen*, which consists of a series of segments attached by membranes. Each of these segments is formed of two arcs or semi-segments, one above and the other below. The abdomen is the seat of the organs of reproduction and alimentation. The senses of insects are dependent upon the nervous system, which consists of a series of nervous masses or ganglia, joined together by two nervous threads, the whole constituting a nervous chain, from which nerves ramify to the different organs, enduing them with the various senses they possess; from the first ganglin the nerves of the eyes and antennæ are fed, and from the second the mouth. Hearing and smell are certainly possessed by insects; but by what organ they are appreciated is not ascertained. Taste the seat of which is the mouth, sight in the eyes, and touch probably in the antennæ, the palpi, and in the tarsi of the feet.

The circulatory system is well represented in insects. The blood is generally colourless, but occasionally of a greenish or reddish hue. The heart, which comprises a series of large reservoirs in the form of a long tube plainly discernible through the transparent skins of caterpillars, lies above the alimentary canal on the upper surface of the body.

Insects do not breathe, like large animals, through their mouths; but by means of breathing-holes in their sides, which connect with two great air canals (tracheæ) which run along the sides of the body, and from which smaller tubes convey the air in very small volumes to different parts of the body, and so oxygenate the vital fluid in its passage. In the Arachnida this tracheal system is considerably modified, respiration being effected among some spiders by ordinary ramified tube-tracheæ, and among others in certain sacs or cavities in the abdomen which have been called pulmo-branchiæ from an idea that they partook both of the nature of the lungs of the higher animals and the branchiæ or gills of fishes; as, however, the blood does not penetrate these sacs but is merely oxygenated in its passage by and round them, while it is being re-collected after use and previous to being sent back to the dorsal vessel or heart, these cavities are now believed to be tracheæ localized within a peculiarly furnished sac. Tube-tracheæ when examined with the microscope are wonderfully beautiful. Traversing as they do the whole bodies of insects, many of which are soft-bodied, they must necessarily be very flexible, and it might be supposed that the rapid movements of the insect might sometimes cause them to collapse, in which case the circulation of the air would be stopped. Upon examination we find that there is a beautiful and simple contrivance which renders this impossible. The tubes consist of a double integument between which runs a hair-like spirally-twisted fibre, just like the coil of wire which is sometimes put inside india-rubber speaking tubes; this adds considerably to the elasticity of the air vessels, and when these collapse through the movements of the insect, it prevents the opposite sides from adhering, and causes them to resume their tubular form as soon as the pressure is removed. There are generally nine pairs of breathing pores or openings through which the air is admitted into the tracheæ. These openings are so constructed that it is impossible for dust to enter the tracheæ. At the outside orifice is a corneous plate, and inside that is a hollow chamber, and then at the other side of that is another valve. In perfect insects nearly all the air enters through the thoracic spiracles.

"When an insect is preparing itself for flight, the act of respiration resembles that of birds under similar circumstances. At the moment of elevating its elytra and expanding its wings, which are indeed acts of respiration, the anterior pairs of spiracles are opened, and the air rushing into them is extended over the whole body, which by the expansion of the air-bags is enlarged in bulk, and rendered of less specific gravity; so that when the spiracles are closed at the instant the insect endeavours to make the first stroke with, and raise itself upon its wings, it is enabled to rise in the air, and sustain a long and powerful flight with but little muscular exertion." In the pupal and larval state respiration is performed almost equally by all the spiracles; but in the imago almost all the air enters by those in and near the thorax, so that generally a pinch under the thorax will kill most soft-bodied insects by suffocating them.

Of the seven sub-orders into which true insects are divided, the one to which the first place is accorded is called Hymenoptera or membrane-winged insects. The members of this sub-order are easily recognized by the structure of the wings which are four in number (see fig. 45), membranous and without either scales or hairs; the second pair is always smaller than the first and the wings have not so many veins. On their anterior margin they have a row of stiff hooklets by which they are securely fastened to the front wings when in use. The veins in the wings are of great use in determining the genera; there are, however, some which are wingless; but may be easily recognized as belonging to this sub-order from their transformations and general structure.

The transformations of this sub-order are the most complete of all insects; the larvæ in general form being more unlike, while the pupæ are more like, the perfect insect than in any other. The natural history of the Hymenoptera is full of interesting and instructive facts and furnishes examples of wonderful instinct and exquisite adaptation. Most of these will be observed in the care they take in providing for their young, and in laying up stores of food for winter use. It is owing to these highly developed instincts, added to the important part they play in the fertilization of many plants, in some cases being actually necessary, that Dr. Packard has placed them first in his system.

By far the larger proportion of these insects are beneficial, and feed either in the larval or perfect state upon other insects. Of beneficial insects mention must first of all be made though of the Honey Bee, concerning which alone whole volumes have been written, and afterwards of the different wasps and allied genera which feed upon and store up for the sustenance of their grubs enormous numbers of caterpillars and other insects, as well as acting as scavengers. Among the social bees, wasps and ants, there are found not only males and females but also other kinds of individuals which are necessary for the successful propagation of the species; these are called neuters and sometimes labourers or nurses; they are however essentially females, having the female organs but in an imperfectly developed and passive state, their sting being only an accessory part, which is changed into a special weapon of defence, and is the homologue of the ovipositor in fertile female insects. The worker bee, besides collecting the honey and pollen which is to serve as food for the offspring of the queen, has to carry the eggs from the queen to their proper cells and feed the larvæ when they are hatched; they are therefore indispensable for the propagation of the race.

I class wasps among beneficial insects, because the sting for which they are dreaded is never used against man, except as an instrument of defence, while its proper use is the destruction of his enemies, the caterpillars of numerous noxious species of insects.

Although some members of the wasp family do fill their cells at certain periods with honey, the food of the greater part, undoubtedly, consists of animal matter, chiefly other insects, which they either seize with their mandibles, or when it is to be stored away for the use of the larvæ, they sting to death. The poison introduced by the sting owes its virulence to the presence of a peculiar acid known as formic acid. This acid is said to be chemically very similar to chloroform, and its action upon insects stung to death is very peculiar. It does not kill them out-right, but paralyzes them, so that they live for many days,and in some cases larvæ have been known to turn into pupæ after having been stung, but have not had sufficient strength to complete their final change into *imagines*. The use of this antiseptic property of the poison is easily seen. The mother wasp, having prepared the nest for her young, fills it with insects which she stings to death; she then lays an egg and closes up the nest. Upon the grub hatching it has a larder well supplied with provisions which will keep fresh as long as required for it to complete its transformations.

The Ants do not demand much of our attention in this country as either injurious or beneficial insects, although there are a few species which are occasionally troublesome and destructive to posts and fences. The almost human aspects of ant-life, however, as exhibited by different species, provide a favourite study for the entomologist, and an investigation of them could not fail to fill even the least curious with wonder and amazement. Their dwellings are constructed on the most scientific architectural patterns; some species have their cows (aphides) which they tend with the utmost care. There are some again which make expeditions against less powerful ants, and carry them off to serve them as domestic servants, upon which they are entirely dependent, and without which they are almost helpless. Others, notably the celebrated Agricultural Ants of Texas, cultivate the ground, reap the harvest, and store up the grain. It is evidently to a species belonging to this class that Solomon refers when he says: "Go to the ant thou sluggard, consider her ways, which . . . gathers her food in the harvest." There are at least seven species of ant in Palestine which harvest the seed of grasses. In England Curtis mentions one which sometimes carries off sufficient seed from turnip fields for it to be termed an "insect pest." Perhaps the most astonishing analogy to human customs is found in a description given at page 217 of the 5th vol. of the Journal of the Linnæan Society, of some ants in New South Wales which bury their dead with funeral honours, and punish with death those not joining in the ceremony, and then as a further mark of degradation bury them in a different place, all together in one hole.

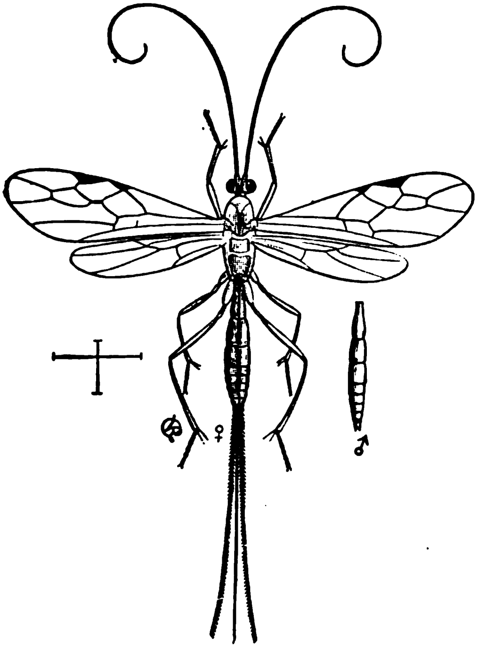

Fig. 51.

Of all the Hymenoptera beneficial to the farmer, none bear comparison with the several species of parasitic ichneumon flies, which lay their eggs in the bodies of other insects, in which the grubs live, and from the juices of whose bodies they derive their nourishment; it is curious, too, that these unbidden guests avoid most carefully all the vital parts of their hosts, and frequently the larvæ, with their strange inhabitants, change into pupæ before the parasites are evolved. These flies are, as a rule, very characteristic in appearance, and thus easily recognized. Fig. 51 represents one of these parasites (*Macroceptrus delicatus*), with its long delicate sting, which attacks the codling moth. For the most part they bear a very long ovipositor, with which they insert their eggs into the bodies of the insects which are to form their nursery. The abdomen of this family presents an almost endless variety of forms, which are adapted to the requirements of its chief use, viz.: the support of the organs of reproduction. In *Pelecinus polycerator*, the scorpion fly, the abdomen of the female is long and slender, while that of the male is short and club-shaped. In *Rhyssa lunator*, the handsomest of all our ichneumons, the ovipositor of the female produced to the extraordinary length of between three and four inches. It may frequently be found dead upon trees, securely fastened there by this organ, which it has been unable to withdraw after having deposited an egg in the body of some larva lying hidden beneath the bark. The genus Ichneumon proper is one of very great extent and usefulness. Two of its species are very common, and have been found to be the chief checks upon the multiplication of the dreaded Army Worm (*Leucania unipuncta*). Figs. 52 and 53 show the Army Worm in both the larval and perfect conditions. These two beneficial insects are *I. suturalis* and *I. paratus*. It is probably safe to say that there is no insect which is safe from the attacks of the ichneumons, and this statement also holds good even with regard to themselves.

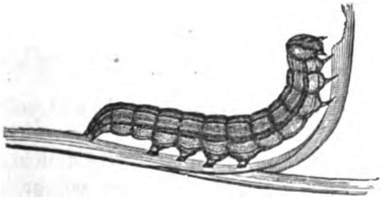

Fig. 52.

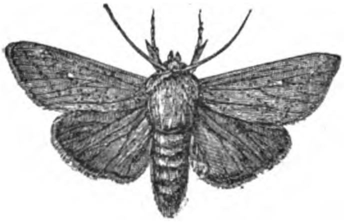

Fig. 53.

To the genus *aphidius* belong several minute species which destroy the different kinds of plant lice.

There are even some which are parasitic upon the eggs of other insects, and which are so small that a magnifying glass is required to distinguish their forms.

Among the Chalcididæ are some exceedingly interesting insects. All are of small size and usually of shiny colours. The small species of parasitical Hymenoptera are particularly useful to man as checking many of the injurious species of Diptera, which from their smallness have so far baffled all efforts to counteract them, and the Chalcididæ have received a high place in the estimation of all from the discovery that they prey upon some of those species which have appeared in such numbers as sometimes to threaten the total destruction of certain crops throughout whole districts, as for instance the various species of Cecidomya, a genus which includes many of the most dreaded pests as the Hessian fly, the wheat midge, the clover leaf and clover seed midges, and also many gall-forming species.

And now we come to some injurious kinds of Hymenoptera—first of all the gall flies which are closely allied to the chalcids; but are plant parasites. When the egg is laid in the leaf or green bark of a plant an abnormal growth of the vegetable cells is brought about which forms large tumors; upon the substance of these the larvæ feed. "These insects are examples of the uses that lie hidden in nature. Many thousand years had the gall flies been making their wonderful cells before any one discovered that the galls which disfigured the oak could be of any service to man. Yet within the gall lay the principal element of the ink which has had as important a part to play in civilization as the press itself, the latter depending almost wholly on the former. Scarcely larger than average sized hazel-nuts, the galls absolutely crowd the branches of an oak which grows plentifully in the Levant, and so it is to these insignificant insects that we owe one of the most absolute necessities of modern existence."*

The saw-flies seem to be a sort of intermediate link between the Hymenoptera and Lepidoptera; while the perfect flies are certainly Hymenopterous the larvæ closely resemble the caterpillars of Lepidoptera, they may, however, be easily known by the number of their legs which is twenty two, while true caterpillars have only sixteen, and also by a habit of curling up the hind part of the body when at rest; when full grown they spin a hard silken coccoon. The saw, or ovipositor, is a beautiful and complicated apparatus; with it the female makes incisions in different parts of leaves and deposits an egg in each slit. Some, however, as the common gooseberry fly (*Nematus ventricosus*) lay their eggs on the under side of the leaf (as shown in fig. 54), not inserted in the substance of it at all.

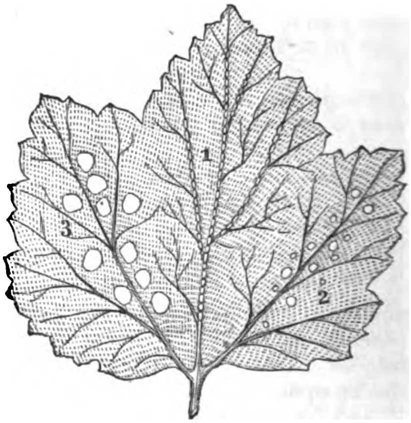

Fig. 54.

These insects are exceedingly troublesome, and have to be constantly watched and treated to "hellebore" or they will entirely denude the gooseberry and currant bushes just at the time the fruit is forming, when the leaves are most wanted. I am happy to say, however, that I have noticed this year considerable ravages among these larvæ and those of the common white butterfly, made by some fungous disease.

Another too well known saw-fly larva is the pear-tree slug (*Selandria cerasi*), which is sometimes very destructive.

There is also belonging to this sub-order a clumsy bow-legged purple and yellow fly, with clubbed anteunæ called *Cimbex Americana*, the large handsome larva of which may frequently be found feeding on birch and elm trees; it is white, with a delicate greenish-yellow tint, and has a black line down its back and a spot of the same colour at each spiracle.

The last family is the Uroceridæ or horn-tails, so called from a long horn upon the abdomen of the males, the object of which is probably protective in adding to the already formidable appearance of these insects. In colour and movements as well as somewhat in form, they much resemble wasps. This family was fully described by Mr. Harrington in the *Canadian Entomologist* for May of this year.

J. Fletcher, Ottawa.

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* Wood's "Insects Abroad."

A CHAPTER ON MITES.

By Wm. Saunders, London, Ontario.

These tiny creatures, of which there are very many species, although not usually regarded as true insects, are closely allied to them, and have been classed with them by many authors. They have been included in the order **Aptera**, or wingless insects, which also embraces spiders, lice, etc. Small and apparently insignificant as these mites are, some species are grievous pests, others invade articles of food, while some others are parasitic on larger insects, and often cause their death. So little is generally known in reference to the habits and life-history of these minute creatures, excepting to those few naturalists who have paid especial attention to this subject, that it is hoped that a brief sketch of the most notable of the species will prove an acceptable and interesting chapter to most of our readers, and, at the same time, convey some useful information. A considerable portion of the material we shall present has been gleaned from the excellent work on **Aptera**, by the late Andrew Murray, F.L.S., the first of a series of works on Economic Entomology designed to serve as hand-books to the South Kensington Museum; a series which he had undertaken, but which his life proved too short to permit him to complete. The accompanying figures have also been chiefly obtained from the above work. These have been engraved by Mr. P. J. Edmunds, of London, Ont., and are faithful representations of the original cuts.

Mites vary very much in form, size and habits, but in their structure they have always some points of resemblance to each other. While nearly related to the spiders, mites never have the abdomen pedunculated, that is, joined to the body by a narrow point of attachment, as is the case with spiders, but it is always in one piece, and united to the last of the segments which bear the legs without any marked depression between them. When mature, as a rule, they all have eight legs; in some instances the hind pair is only partially developed, but traces of them can almost always be discovered. In their earlier immature stages mites have only six legs.

The known species are very numerous, and are divided into eight different families.

1. **Trombidiinæ**, containing
    1. **Tetranychi**, spinning mites.
    2. **Trombidiidæ**, harvest mites
2. **Bdellidæ**, snouted harvest mites.
3. **Hydrachnidæ**, water mites.
4. **Gamasidæ**, insect mite-parasites.
5. **Ixodidæ**, ticks.
6. **Halacaridæ**, marine mites.
7. **Oribatidæ**, beetle mites.
8. **Acaridæ**, including
    1. **Hypoderidæ**, subcutaneous mites
    2. **Hypopidæ**, ichneumon mites.
    3. **Tyroglyphidæ**, cheese mites.
    4. **Sarcoptidæ**, itch and louse mites.
    5. **Phytoptidæ**, gall mites.

In the first section of the

TROMBIDIINÆ

we find the genus *Tetranychus*, to which the "red spider" (*Tetranychus telarius*) belongs. This is a serious pest to gardeners, and one which all those who have to do with plants under glass are more or less familiar with. Fig. 55 represents the male of this species, very much enlarged, the mite itself being scarcely visible to the unaided eye. (The small dot within the circle at the side of the figure indicates the natural size.) The characteristics of this genus of mites seem to show a special affinity with the spiders, in their habit of spinning webs, for which purpose the claws of their feet are specially adapted. The mouth has a barbed sucking apparatus, by which the sap is sucked from the minute vessels in the leaves of the plants they attack. These mites vary very considerably in colour, influenced much in this respect by the food they devour; some are greenish and marked with brown specks on the sides, others are rust-coloured, or reddish, or even brick-red, the latter being the colour with which horticulturists are most familiar. It is probable that most of the individuals acquire more or less of a reddish hue, when fully mature.

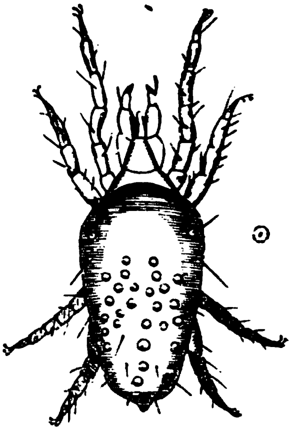

Fig. 55.

This mite spins a web on the under side of the leaves, of the finest and most delicate texture, the threads being so slender, that one fails to see them, even with the help of a magnifying glass, until after they are woven into a web or net-work. The threads are secreted from a conical protuberance situated underneath and near the extremity of the abdomen, and they are drawn out and guided by the motions of the insect, and by the action of the minute claws of the feet. In constructing the web the feet are moved quickly, and the threads are attached to the hairs and other prominences of the leaf, and under this shelter will be found a colony, consisting of many mature individuals of both sexes, and young mites of all ages, which feed and multiply rapidly. By the aid of their jaws, which are not unlike the beak of a bird, they tear away the surface of the leaf, and then plunge their beaked suckers into the wound and suck the juice.

The eggs of this mite are nearly round, colourless, and large in proportion to the size of the insect. The larva is a minute transparent object, not unlike its parent, but it has only six legs and creeps slowly. The leaves of the plants attacked soon indicate the presence of this invader by their sickly hue, the sap being sucked by myriads of tiny mouths the leaves are deprived of their natural nourishment, and soon assume a yellowish cast, with patches of a grayish or lighter shade, the under surface becomes whitish, and if the the mite is allowed to pursue its course unchecked, the gardener soon finds his cherished flowers and shrubs much injured or destroyed.

This insect is said to pass the winter under stones, concealing themselves there when the leaves they have fed on have fallen.

The remedies used for such enemies as the red spider are various preparations of sulphur and soap, used separately or together, mixed with water, and applied to the plants with a syringe. Sulphur in any form seems useful; laying it in the form of powder upon the pipes in the greenhouse has been recommended. Plain soap and water is said to be effectual, indeed water alone freely used is regarded by some as sufficient; it is well known that the insect thrives best in a dry atmosphere. In applying these liquids, to insure success it is necessary that it be used so as to wet the under side of the leaves, if applied to the upper surface only, the mites may remain attached to the lower side with perfect security during the entire operation. The gardener is aided in his war against this pest by other mites and insects which prey upon them. The larvae of the lace-wing flies, and other friendly insects, are said to devour large numbers of them.

There are a number of other species belonging to the genus *Tetranychus* which injure plants and trees. The cucumber, the rose, the cyclamen, the vine, have each a different mite which devotes special attention to them; another species is found only on various members of the family of Cacti; while there are still other species which affect other plants, shrubs and trees. Since the habits of all these are similar the remedies recommended for the red spider, will probably prove equally efficacious in these instances.

THE HARVEST BUG (*Tetranychus autumnalis*),

is of a brick red colour, and so small as to be scarcely visible to the naked eye. Figure 56 represents it in the larval or six-footed form, highly magnified. This insect has peculiarities in habit which distinguish it from those already mentioned. Though bred upon plants, such as beans and other vegetables, also on currant, raspberry, and gooseberry bushes, yet when opportunity presents, they will desert these and fasten on animals, manifesting a particular fondness for the human race, especially women and children. The mites fasten upon the skin. particularly where any part of the dress fits closely, and there adhere by their claws so firmly that they can scarcely be detached without violence. Where one of these mites fixes itself a swelling occurs about the size of a pea, sometimes much larger, accompanied with severe itching, the severity of the swelling and itching varying in different individuals. In the chalky districts of Hampshire, England, these pests are especially abundant, also in some parts of Scotland and France; they do not confine their attacks to mankind, but are troublesome also to horses, cattle, sheep, dogs, cats and rabbits. It is in the larval or six-footed form in which this species is most frequently met with, the perfect eight-footed insect being seldom seen.

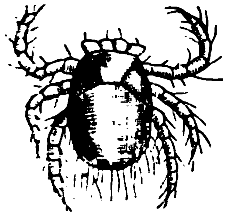
Fig. 56.

Kirby and Spence mention a similar insect which occurs in Brazil in great numbers. They insinuate themselves into the skin, and occasion intolerable itching, followed by larger swellings which subside in a day or two. Another species with similar habits occurs in Mexico.

TROMBIDIUM IRRITANS,

commonly known as the harvest mite, or "jigger," (fig. 57) is met with in the Mississippi valley where it is very troublesome, and produces much irritation in the skin wherever it attaches itself. Many species of harvest mites also feed on the leaves of plants, but they do not spin webs. They are also found in damp moss or on moist earth or stones, and vary in size from a pin's point to a pin's head. Those belonging to the genus *Trombidium* are parasitic in their habits.

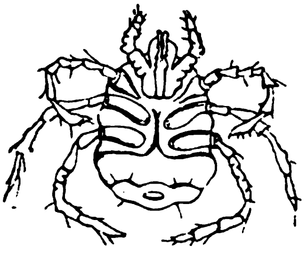
Fig. 57.

TROMBIDIUM PARASITICUM

is a minute blood-red mite which attacks the house-fly. Prof. Riley, in his Seventh Annual Report states that in some seasons in the west scarcely a fly can be caught that is not infested with a number of these blood-red mites clinging tenaciously around the base of the wings. The accompanying figure (58) represents this mite in its immature state.

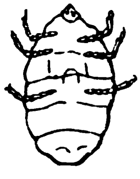
Fig. 58

TROMBIDIUM HOLOSERICEUM.

This speces is found in Europe attacking the long-legged harvest spider, adhering generally behind the haunches. It is of an orange scarlet colour.

TROMBIDIUM BULBIPES

is a mite described by Dr. Packard in his Third Report on Injurious and Beneficial Insects in Massachusetts. He found it on rose bushes in his garden where it was busily engaged devouring plant lice. It is of a scarlet red colour.

The Grasshopper Parasite (*Trombidium gryllarium*).

As in other classes of insects, mites furnish us with friends as well as enemies. In this instance we find an ally who carries on war against the grasshoppers. Harris, in his "Insects Injurious to Vegetation," page 191, draws attention to the fact that locusts in the Eastern States "are much infested by little red mites; these so much weaken the insects by sucking the juices from their bodies, as to hasten their death. Ten or a dozen of these mites will frequently be found pertinaciously adhering to the body of a locust, beneath its wing-covers and wings. A mite similar if not identical has been found at work among the swarms of locusts which inhabit the Western States. It is described by Dr. Le Baron in his first Report on the Insects of Illinois, in 1872. Figure 59 represents it in the larval condition. They are red, about one-thirtieth of an inch in length, and are found chiefly on the under side of the basal half of the under wings where they adhere so firmly that it is difficult to scrape them off with a pen-knife. The mite so attached soon swells so much that its six small legs, quite visible at first, become almost invisible, lost in the swollen body. These little mites help much to reduce the numbers of the destructive locusts; they suck the bodies of their victims until they beeome exhausted and die.

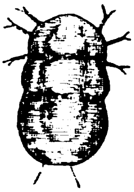

Fig 59.

Trombidium Sericeum.

This species (fig. 60) in also red. It has been found devouring the eggs of the destructive locusts in Iowa and Minnesota, creeping into the holes in which the eggs have been deposited and devouring their contents.

During the winter of 1878 an undetermined species of *Trombidium* was observed by me devouring the eggs of the moth of the forest tent caterpillar. On examining some egg clusters one evening under the microscope it was observed that at some points the glutinous coating which covers the clusters was imperfect, that a piece here and there had disappeared leaving the eggs bare, and in some cases some of the exposed eggs were empty. On cutting into the clusters they were found to be colonized by mites. The outside gummy matter is of a sufficiently porous texture to afford shelter to these little friends, who had evidently eaten into the eggs and devoured the young larvæ, and had also consumed the missing portions of the gummy covering. In the range of a single section of an egg-mass some eggs would be found uninjured, while from others there would proceed several (in some instances as many as five) active little mites, who, when thus disturbed, would run in and out of their dwelling places, at the same time keeping up a peculiar drumming motion with their tiny antennæ. Besides the smaller, younger specimens, four or five of which could find ample room and to spare within a single egg shell, there were other larger specimens apparently of the same species, but more mature. These were of a pale red colour, with bright, red eyes, more sluggish in their movements, and one such specimen would nearly fill an egg. On the outside, clusters of pale red eggs were found, supposed to be the eggs of these mites.

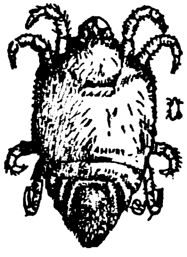

Fig. 60.

On almost every egg-mass examined some of these mites were found, and if they are thus generally distributed over the whole area inhabited by these moths they must prove a very efficient check to the undue multiplication of the species. There are mites also which prey upon the eggs of the oyster-shell bark louse, and on those of the canker worm.

Among other families of mites may be mentioned the

Snouted Mites (*Bdellidæ*),

the fresh water mites, most of whom live on water insects, there are also some species of mites found in salt water. Besides these there are the Gamasids, many of which are parasitic on insects, while some are troublesome to birds and other animals, *Gamasus coleoptratorum* and *G. marginalis* are found on various beetles. *Uropeda vegetans* also attacks beetles. When a beetle is infested with this mite, it seems as if covered by a large number of small fawn-coloured shining convex scales, attached to various parts of the underside of the body, and on the parts infested, covering the body so completely that none of it can be seen. They are not easily detached, and when forcibly removed they do not fall off but hang by a fine thread, exuded from their bodies, which is attached to the beetle. There is also the forage mite, which is found in Europe, in great numbers amongst old hay, and which when shaken down from the rack, on the heads and necks of the animals feeding on it, occasions them much annoyance.

DERMANYSSUS AVIUM

is the so-called tick, that infests domestic poultry, canaries and other cage birds. Fig. 61 gives a good idea of this creature, which is not much larger than a cheese mite. It lives especially in poultry houses, and on their inhabitants, and from these the mites sometimes migrate to the persons who have charge of them, and occasion them considerable annoyance. These mites also infest the cages of singing birds, and harbour about the crevices in the cage, and about the perch, from which they sally during the night, and burrow among the feathers of the sleeping birds and suck their blood. Other species belonging to this genus and allied genera feed on swallows, pigeons, doves and other birds, also on bats, indeed on this subject, did space permit, we might enlarge almost indefinitely, since there are species infesting almost every species of bird, beast and reptile in existence, as well as many insects, and on a variety of vegetable substances, especially mosses and fungi. One species has been found in the abdominal cavity of a dead flea, thus:

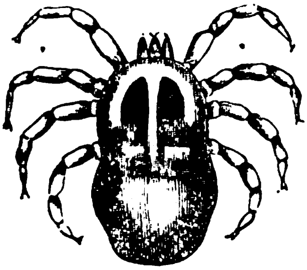
Fig. 61.

"The little fleas, that do so tease,
Have smaller fleas that bite 'em,
And these again have lesser fleas,
And so *ad infinitum*."

In the genus

TYROGLYPHUS

are included several interesting and well known species. *Tyroglyphus entomophagus* feeds on animal substances, being very partial to the dried insects, in the collections of the entomologist. In fig. 62 we have *Tyroglypus mycophagus*, a closely allied species, highly magnified; they are both very minute, yet easily seen with the naked eye. When once *T. entomophagus* gains access to a collection its presence is soon evidenced, by the dust which gathers on the bottom of the drawers, under or about the insects on which they are feeding. If allowed to proceed unmolested, they soon so far devour the bodies of the specimens so attacked, as to reduce them to a mere shell, which frequently falls to pieces in the handling. They are especially destructive to moths and butterflies. As soon as any appearance of dust occurs under any of the preserved insects in a case, such specimens should be at once attended to, and treated with a liberal application of Benzine, which will kill the mites without injuring the subjects infested. Insects which have not been thoroughly dried before being placed in the cabinet, are most liable to attacks, especially such as have been bred. Exposure to dampness also favours the

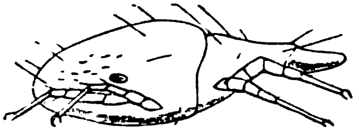
Fig. 62.

increase of mites, especially if associated with mouldiness; indeed mould and mites most frequently go together.

THE COMMOM CHEESE MITE (*Tyroglyphus siro*).

This tiny creature, scarcely visible to the unaided eye, is soft, smooth and fleshy, with a whitish body, and feet furnished with suckers and claws. Fig. 63, which represents one of these mites highly magnified, will convey a better idea of its general aspect than any verbal description we can give. It lives in almost every kind of cheese when a little decayed, and particularly in the harder portions. When in a warm atmosphere they are active, constantly gnawing at the cheese and reducing it to powder. This powder is composed of little greyish balls of excrementitious matter, eggs, both empty and unhatched, larvæ, pupæ, and perfect mites, with cast skins and fragments of cheese; Exposed to a low temperature, the individuals soon gather into groups or heaps in hollow places in the cheese, and there remain in a state of torpidity until awakened again by warmth. This mite is also found in flour.

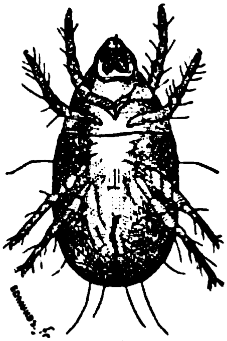
Fig. 63.

It multiplies very rapidly either in cheese or flour. A few specimens transferred from a mitey cheese to an old cheese not mitey, will soon colonize it thoroughly. They are probably harmless, since there are no records of any disease occasioned by them, although they are daily eaten in numbers too great to be estimated, and so carelessly, that hundreds of living individuals must escape the grinding of the molars and be swallowed alive.

THE SCARCER CHEESE MITE (*Tyroglypus longior*).

This species is found associated with the common cheese mite, but seldom in any great abundance, rarely in larger proportion than fifteen or twenty, and sometimes not more than one, to a hundred. It is very easily distinguished from the common cheese mite, by its larger size, greater length of body, and longer hairs, while very similar in its habits it is much quicker in its movements. This species also attacks the dried Spanish flies or cantharides kept by druggists, and used for blistering purposes. A French naturalist, M. M. Fumouse, has studied the life-history of this mite, by placing some of them with a sufficient supply of food between two plates of glass. The females laid oval eggs in great abundance, which hatched in from ten to fifteen days, the young mites being at first as usual six-footed. During their growth, and after casting their skins once or twice, they acquire an additional pair of legs, making eight in all, and soon reach maturity.

This species some fifty years ago acquired much notoriety on account of its having been stated that it could be produced by electricity. At that time the idea obtained in the minds of some that electricity was the source of many of the phenomena of life. Two experimenters, Messrs. Cross and Weekes, of England, endeavoured to ascertain whether organic beings could not be produced by electricity. For this purpose pumice stone kept moist by a dilute solution of silicate of potash and muriatic acid was subjected to a constant stream of electricity, and after a time some of these mites were found wandering about the apparatus, and the conclusion was at once arrived at that they had been produced through the agency of electricity. A specimen was sent to a French naturalist who had made a special study of mites, who found it to be a female of this species with its body distended with eggs, which, as he drily remarked, seemed rather an unnecessary complication in a new creation.

TYROGLYPHUS MALUS

(fig. 64), is a North American mite, which is a friend to the fruit grower since it destroys the eggs of the oyster-shell bark louse, so injurious to the twigs of the apple tree.

Passing by the sugar mites which are found in such abundance in the commoner grades of brown sugar, we come to the family *Sarcoptidae*, which includes a class of mites which infest animals and burrowing under their skin cause irritation and swellings. The most notable and familiar example in this class is the

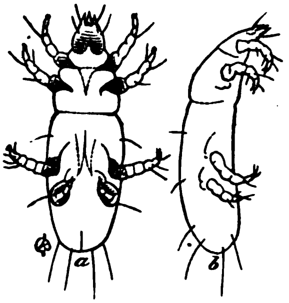

Fig. 64.

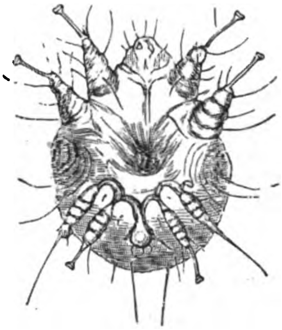

Fig. 65.

ITCH MITE *(Sarcoptes scabiei)*.

Figure 65 represents a male of this species highly magnified; naturally they are so small as to be distinguished with difficulty by the unaided eye. This tiny, bristly creature lives under the human skin in little tunnels eaten away by itself. In fig. 66 we have one of these minute channels represented with the female mite at one end. As she works her way under the skin she lays her eggs behind her as shown in the figure, which hatch in from four to six days. It is said that one mite will lay as many as fifty eggs. The young mites have but six legs, and during their growth change their skin four times, at the final moult acquiring an additional pair of legs, or eight in all. When one of the vesicles caused by this insect is minutely examined a tiny spot will be found upon some part of its surface, this is the point where the mite has entered, and from it a faint line or streak may be traced, usually more or less curved, which is the burrow which the creature has made, and in which it lives. The burrow varies in length, and is sometimes as much as five or six inches long, and at the end, under a slight elevation of the skin, the little pest lies concealed, and if the skin there be gently raised with the point of a needle the mite may be easily extracted, as the little creature clings with its sucker-like feet to any object with which it may come in contact.

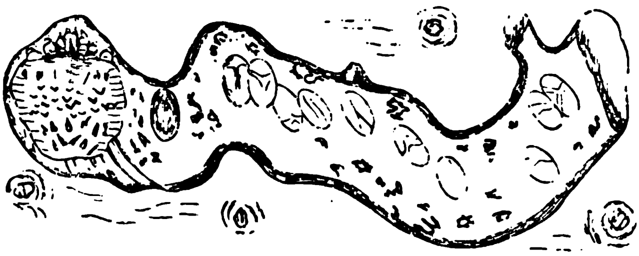

Fig. 66.

The unpleasant disease referred to is of course occasioned by this mite, and is transferred by those infected to others, sometimes by actual contact, but more frequently by occupying beds with an infected person, or after them. This is readily accounted for from the habits of the mite, which during the day hides under the skin, but is active and leaves its hiding place at night. This pest was formerly much more common than it is now, the more general and free use of soap and water has done much to render it scarce; still, sometimes, when bodies of men are crowded together, with little opportunity to attend to personal cleanliness, it appears and spreads rapidly.

ANTS.

By the Rev. C. J. S. Bethune, M.A., Port Hope, Ont.

No family of insects is more widely distributed and more generally familiar to mankind than that of the ant, while its habits of industry and activity have been proverbial amongst all nations since the days of Solomon. Some account of its natural history and curious habits cannot fail, we think, to be of interest to the readers of these Reports.*

1.—INTRODUCTORY.

The insects included under the common name of ant belong to two very different orders, which present strongly marked characteristics both in structure and in habits. Our common ants in this conntry are all members of the same order of insects *(Hymenoptera)* as bees, wasps and saw-flies, and possess many of the familiar peculiarities of the first mentioned. In tropical countries there is another family of ants, known by the name of *Termites* or white ants, and equally interesting to the lover of natural history; these belong to the order *Neuroptera*, which includes dragon-flies, May-flies, caddis-flies and other well-known insects. Of these we shall not at present treat, though as the white ants have become troublesome as far north as Boston, and may possibly be found in Canada, we shall probably give some account of them on a future occasion.

The insects of the order *Hymenoptera* are distinguished by the possession in their perfect state of four membranous wings, though occasionally the wings are wanting, as in the case of certain members of the ant community. The mouth is furnished with organs for mastication and suction; the abdomen in the female is provided with an ovipositor or a sting; the eyes are generally large and prominent, occupying in some cases the greater portion of the head. The Hymenopterous insects also undergo a "complete metamorphosis"—that is, they go through four distinct changes, first the egg, secondly the grub or larva, third the quiescent pupa or chrysalis state, and lastly the perfect imago or winged insect. They are remarkable among insects, and indeed amongst all the lower tribes of animals, for the wonderful development amongst many families of social instincts of a high order, living as they do in large communities regulated by definite laws, each member of the society apparently subordinating his individuality to the welfare of the general community, and therefore performing certain definite duties of a public character.

2.—STRUCTURE.

The common ants to which we are now referring belong to the family *Formicidæ*; they are distinguished by their habit of residing in more or less numerous societies either under ground or in decayed timber, whence arises the necessity for a greater number of individuals having their sexual organs abortive, so as to be able to devote themselves without interruption to the labours of the community; for this purpose also they are destitute of wings. The males and females, possessing wings, are naturally much less numerous, being only required for the propagation and continuance of their species. There are thus three grades of inmates in each society, termed respectively, males, females and neuters.

The males have a small body, with long and slender legs and antennæ, and are furnished with wings which they retain during life. The females are much larger, with shorter and thicker legs and antennæ; they are also furnished with wings, but cast off these

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* In the compilation of this paper, free use has been made of the following works:—The article "Ant" in the *Encyclopædia Britannica*, 9th edition, vol. ii; Packard's *Guide to the Study of Insects;* Kirby and Spence's *Entomology;* Westwood's *Introduction to the Modern Classification of Insects;* Moggridge's *Harvesting Ants and Trap-door Spiders;* Miss Mary Treat's *Chapters on Ants;* etc., to which the reader is referred who desires fuller information.

organs after the process of pairing is over, and they are about to lay their eggs. The workers or neuters are somewhat smaller than the males, with antennæ resembling those of the females, being thickened to the tips, and elbowed; they are always destitute of wings. They often consist of two forms: one with a large cubical head, or worker major, sometimes called a soldier, and the other the ordinary small-headed form, or worker minor. The antennæ of the male ants possess thirteen joints each, and those of the female and neuter twelve each. The head, including jaws, is more or less triangular in shape, broader behind than the thorax in the neuters, but somewhat narrower in the males and females. The mandibles or large jaws of the females and neuters are larger than those of the males, and are frequently toothed or serrated, sometimes hooked or sickle-shaped. The abdomen of the male consists of seven joints or segments, and that of the female and neuter of six. The external sexual organs of the neuters correspond to those of the females, but the internal reproductive organs are wholly undeveloped.

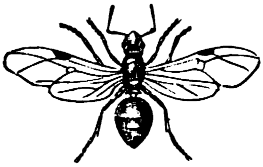

Fig. 67, Female Wood Ant (*Formica rufa.*)

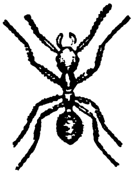

Fig. 68, A Neuter Leaf-cutting Ant (*Eciton drepanophora.*)

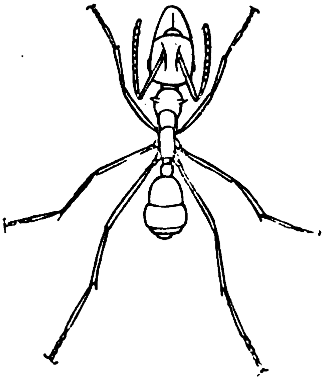

Fig. 69, Worker Major (*Ectatomma ferruginea*).

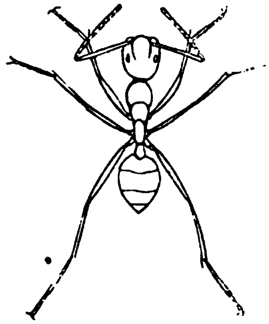

Fig. 70, Worker Minor (*Formica fulvacea*).

During the summer the winged males and females are produced in large numbers, and they soon leave the nest to take their "nuptial flight" in the air, in the course of which the females are impregnated. The function of the male ants having been thus performed, they die; the females, after impregnation, pull off their wings, and whilst in this somewhat helpless condition are conveyed by the neuters to new situations, where they lay their eggs and become the founders of fresh colonies.

Each fertile female or "queen" is carefully attended by a retinue of neuters, the latter, as we have seen, being simply females, whose sexual organs are undeveloped. The cause of this differentiation of sex, is probably owing to the nature of the food supplied to the ant during its larval state. Being thus exempted from all sexual functions, the duties of the neuters are confined to the performance of all the offices which contribute to, or are connected with, the welfare and labour of the ant community. They accordingly construct the nest or home, and keep it in constant repair; provide food and sustenance for the whole society; act the part of nurses in carefully attending to the hatching, nutrition and rearing of the young. They are also the defenders of the colony, in that they protect the nest and its inmates from the intrusion or attacks of any foes. In the species which possess two forms of neuters, the worker-majors or soldiers devote themselves especially to the care and protection of the community, and are provided for the purpose with large mandibles or biting-jaws, which constitute efficient weapons of attack or defence; while the worker-minors build and repair, collect food, attend to the young, and perform other household duties.

3. ANTS' NESTS.

Every one, no doubt, is familiar with the external appearance of many kinds of ants' nests, from the minute species which throw up little hills of sand, in our garden walks, to the large varieties which construct great mounds of rubbish in the woods and pasture lands. Few, however, have much acquaintance with the mode of construction, and the arrangement of these strange dwellings. The following account is given by Kirby and Spence:

"The nest of the large red ants, which are common in woods, at the first aspect seems a very confused mass. Exteriorly it is a conical mound, composed of pieces of straw, fragments of wood, little stones, leaves, grain—in short, of any portable materials within their reach. But however rude its outward appearance, and the articles of which it consists, interiorly it presents an arrangement admirably calculated at once for protection against the excessive heat of the sun, and yet to retain a due degree of genial warmth. It is wholly composed of numerous small appartments of different sizes, communicating with each other by means of galleries, and arranged in separate storeys, some very deep in the earth, others a considerable height above it—the former for the reception of the young in cold weather and at night, the latter adapted to their use in the daytime. In forming these, the ants mix the earth excavated from the bottom of the nest with the other materials of which the mound consists, and thus give solidity to the whole. Besides the avenues which join the apartments together, other galleries, varying in dimensions, communicate with the outside of the nest at the top of the mound. These open doors would seem ill-calculated for precluding the admission of wet, or of nocturnal enemies: but the ants alter their dimensions continually according to circumstances: and they wholly close them at night, when all gradually retire to the interior, and a few sentinels only are left to guard the gates. On rainy days, too, they keep them shut, and when the sky is cloudy open them partially.

"The habitations of these ants are much larger than those of any other species in this country, and sometimes as big as a small haycock; but they are mere molehills when compared with the enormous mounds which other species, apparently of the same family, but much larger, construct in warmer climates. Malouet states, that in the forests of Guiana, he once saw ant-hills which, though his companion would not suffer him to approach nearer than forty paces for fear of his being devoured, seeemed to him to be fifteen or twenty feet high, and thirty or forty feet in diameter at the base, assuming the form of a pyramid, truncated at one-third of its height; and Stedman, when in Surinam, once passed ant-hills six feet high, and at least one hundred feet in circumference. In the plains of Paraguay, where the ants commit great devastations, a species described by Dobrizhoffer forms conical earthen nests three or more ells high, and as hard as stone; and in the Bungo forest in New South Wales, a very small ant builds nests of indurated clay eight or ten feet high." These immense mounds are probably the work of some species of *Termites* or white ants, not of the *Formicidæ*.

"The nest of *Formica brunnea* is composed wholly of earth, and consists of a great number of storeys, sometimes not fewer than forty, twenty below the level of the soil, and as many above, which last, following the slope of the ant-hill, are concentric. Each storey, separately examined, exhibits cavities in the shape of saloons, narrower apartments, and long galleries which preserve the communication between both. The arched roofs of the most spacious rooms are supported by very thin walls, or occasionally by small pillars and true buttresses; some having only one entrance from above, others a second communicating with the lower story. The main galleries, of which in some places several meet in one large saloon, communicate with other subterranean passages, which are often carried to the distance of several feet from the hill. These insects work chiefly after sunset. In building their nest they employ soft clay only, scraped from its bottom when sufficiently moistened by a shower, which, far from injuring, consolidates and strengthens their architecture. Different labourers convey small masses of this ductile material between their mandibles, and with the same instrument they spread and mould it to their will, the antennæ accompanying every movement. They render all firm by pressing the surface lightly with their fore feet, and however numerous the masses of clay composing these walls, and though connected by no glutinous material, they appear when finished one single layer, well united, consolidated and smoothed. Having traced the plan of their structure, by placing here and there the foundations of the pillars and partition-walls, they add successively new portions; and when the walls of a gallery or apartment, which are half a line thick, are elevated about half an inch in height, they join them by springing a flattish arch or roof from one side to the other. Nothing can be a more interesting spectacle than one of these cities while building. In one place vertical walls form the outline, which communicate with different corridors by openings made in the masonry; in another we see a true saloon, whose vaults are supported by numerous pillars; and further on are the cross ways or squares where several streets meet, and whose roofs, though often more than two inches across, the ants are under no difficulty in constructing, beginning the sides of the arch in the angle formed by two walls, and extending them by successive layers of clay till they meet; while crowds of masons arrive from all parts with their particle of mortar, and work with a regularity, harmony, and activity, which can never enough be admired. So assiduous are they in their operations, that they will complete a storey with all its saloons, vaulted roofs, partitions and galleries, in seven or eight hours. If they begin a storey, and for want of moisture are unable to finish it, they pull down again all the crumbling apartments that are not covered in.

"Another species of ant (*M. fusca*) are also *masons*. When they wish to heighten their habitations, they begin by covering the top with a thick layer of clay, which they transport from the interior. In this layer they trace out the plan of the new storey, first hollowing out litttle cavities of almost equal depth at different distances from each other, and of a size adapted for their purposes. The elevations of earth left between them serve for bases to the interior walls, which, when they have removed all the loose earth from the floors of the apartments, and reduced the foundations to a due thickness, they heighten, and lastly cover all in. M. Huber saw a single working ant make and cover in a gallery which was two or three inches long, and of which the interior was rendered perfectly concave without assistance.

"The societies of *F. fuliginosa* make their habitations in the trunks of old oaks or willow trees, gnawing the wood into numberless storeys more or less horizontal, the ceilings and floors of which are about five or six lines asunder, black, and as thin as card, sometimes supported by vertical partitions, forming an infinity of apartments which communicate by small apertures; at others by small light cylindrical pillars furnished with a base and capital which are arranged in colonnades, leaving a communication perfectly free throughout the whole extent of the storey.

"Two other tribes of carpenter ants (*F. æthiops* and *F. flava*) use sawdust in forming their buildings. The former applies this material only to the building of walls and stopping up chinks; the latter composes whole stages or storeys of it made into a sort of papier mâché with earth and spider's web."

A species of ant (*Atta barbara*) has been found by Moggridge actually to make its nest in solid sandstone rock at Mentone in the south of Europe. He states that he traced some workers to a part of the sandstone rock where steps had recently been hacked out leading to some terraces and thus by accident discovered the nest, which he thus describes:—"I soon saw that the ants entered and came out from three or four small passages in the cleft surfaces of the rock, and that their nest actually lay in the sandstone itself. Having contrived to wedge off several large flakes of the rock, which was soft in most places and might be scooped out with a strong knife, I discovered that though some of the passages of the ants followed the lines of cleavage and the cracks made by the fine wiry fibres of the bushes growing on the surface, others were frequently made in the form of tubular tunnels through the living rock. Without the aid of hammer and chisel it was not possible to follow the galleries and to secure specimens of the mined rock; but on the next day I returned armed with tools, and with the assistance of a friend quarried out a portion of the nest, tracing it down eventually to twenty-three inches below the surface of the rock in a vertical, and to about sixteen inches away from the surface in a horizontal direction. At one point where the rock was almost entirely solid and without flaw or crevice, and where it was clear that the passages were entirely the work of the ants, we measured a tunnel by worming a straw down it, and found it to be ten inches in length. We subsequently traced this tunnel or rock-gallery down until it communicated with a chamber filled with winged ants and seeds of several kinds." He afterwards discovered a second nest of the same kind.

Though almost all ants construct their nests under ground or in decayed timber, a species has been found in India, called *Myrmica Kirbii*, that builds its nests on the branches of trees and shrubs out of a most extraordinary material, namely, cow-dung! The nests are round in shape and about the size of an ordinary foot-ball. Flakes of dry cow-dung are placed upon each other like the tiles of a roof, so that although the insects can creep beneath them into the nest, no water can penetrate them; on the top of the nest there is placed one very large flake that crowns the structure and protects the rest.

4. Slave-making Ants.

Among the many very curious and extraordinary proceedings of ants is the practice, prevalent amongst some species, of making slaves of their weaker brethren. Regular expeditions are made by the slave-makers, commonly called Amazon ants, for the purpose of obtaining fresh supplies from the nests of the inferior species; these captives they compel to do all the hard labour required in their own community. This might seem incredible were it not attested by numbers of independent observers in different countries, some of whose accounts we may now transcribe. There are two species which are known to reduce others to slavery, viz., the russet ant *(Formica rufescens)*, and the red ant *(F. sanguinea)*; of the latter species there is an American variety. The best known descriptions are those made by Huber, a European observer, who devoted the greater part of his life to the minute observation of the lives and actions of insects. The following account translated from his works, is taken from Kirby & Spence:—

"Their time of sallying forth is from two in the afternoon till five, but more generally a little before five; the weather, however, must be fine and warm. Previously to marching there is reason to think that they send out scouts to explore the vicinity; upon whose return they emerge from their subterranean city, directing their course to the quarter from which the scouts came. They have various preparatory signals, such as pushing each other with the mandibles or forehead, or playing with the antennæ, the object of which is probably to excite their martial ardour, to give the word for marching, or to indicate the route they are to take. The advanced guard usually consists of eight or ten ants, but no sooner do these get beyond the rest than they move back, wheeling round in a semicircle, and mixing with the main body, while others succeed to their station. They have "*no captain, overseer, or ruler*," as Solomon observes, their army being composed entirely of neuters, without a single female; thus all in their turns take their place at the head, and then, retreating towards the rear, make room for others. This is the usual order of their march, and the object of it may be to communicate intelligence more readily from one part of the column to another.

"When winding through the grass of a meadow they have proceeded to thirty feet or more from their own habitation, they disperse: and, like dogs with their noses, explore the ground with their antennæ to detect the traces of the game they are pursuing. The negro formicary, the object of their search, is soon discovered; some of the inhabitants are usually keeping guard at the avenues, which dart upon the foremost of their assailants with inconceivable fury. The alarm increasing, crowds of its swarthy inhabitants rush forth from every apartment; but their valour is exerted in vain, for the besiegers, precipitating themselves upon them, by the ardour of their attack compel them to retreat within, and seek shelter in the lowest storey; great numbers entering with them at the gates, while others with their mandibles make a breach in the walls, through which the victorious army marches into the besieged city. In a few minutes, by the same passages, they as hastily evacuate it, each carrying off in its mouth a larva or pupa which it has seized in spite of its unhappy guardians. On their return home with their spoil, they pursue exactly the route by which they went to the attack. Their success on these expeditions is rather the result of their impetuosity, by which they damp the courage of the negroes, than of their superior strength, though they are a larger animal; for sometimes a very small body of them, not more than 150, has been known to succeed in their attack and carry off their booty."

Mr. Kirby corroborates the foregoing account by the following description of his own observations several years later, when he had an opportunity of visiting Paris, and calling upon the celebrated French entomologist, M. Latreille: "He assured me," to quote Mr. Kirby's words, "that he had verified all the principal facts advanced by Huber; at the same time he informed me that there was a nest of the rufescent ants in the Bois de Boulogne, to which place he afterwards was so good as to accompany me. We went on the 25th of June. The day was excessively hot and sultry. A little before five in the afternoon we began our search. At first we could not discern a single ant in motion. In a minute or two, however, my friend directed my attention to one individual—two or three more next appeared—and soon a numerous army was to be seen winding through the long grass of a low ridge in which was their formicary. Just at the entrance of the wood from Paris, on the right hand and near the road, is a bare place, paled in for the Sunday amusement of the lower orders—to this the ants directed their march, and upon entering it divided into two columns, which traversed it rapidly and with great apparent eagerness; all the while exploring the ground with their antennæ, as beagles with their noses, evidently as if in pursuit of game. Those in the van, as Huber also observed, kept perpetually falling back into the main body. When they had passed this inclosure, they appeared for some time to be at a loss, making no progress, but only coursing about; but after a few minutes' delay, as if they had received some intelligence, they resumed their march, and soon arrived at a negro nest, which they entered by one or two apertures. We could not observe that any negroes were expecting their attack outside the nest, but in a short time a few came out at another opening, and seemed to be making their escape. Perhaps some conflict might have taken place within the nest in the interval between the appearance of these negroes and the entry of their assailants. However this might be, in a few minutes one of the latter made its appearance with a pupa in its mouth; it was followed by three or four more; and soon the whole army began to emerge as fast as it could, almost every individual carrying its burthen. Most that I observed seemed to have pupæ. I then traced the expedition back to the spot from which I first saw them set out, which according to my steps was about 156 feet from the negro formicary. The whole business was transacted in little more than an hour. Though I could trace the ants back to a cert ain spot in the ridge before mentioned, where they first appeared in the long grass, I did not succeed in finding the entrance to their nest, so that I was deprived of the pleasure of seeing the mixed society.

"M. Latreille very justly observes that it is physically impossible for the rufescent ants (*F. rufescens*), on account of the form of their jaws, and the accessory parts of their mouth, either to prepare habitations for their family, to procure food, or to feed them.

"*Formica sanguinea* (the red ant mentioned above) is another of the slave-making ants; and its proceedings merit separate notice, since they differ considerably from those of the rufescents. They construct their nests under hedges of a southern aspect, and likewise attack the hills both of the negroes and miners. On the 15th of July, at ten in the morning, Huber observed a small band of these ants sallying forth from their formicary, and marching rapidly to a neighbouring nest of negroes, around which it dispersed. The inhabitants, rushing out in crowds, attacked them and took several prisoners: those that escaped advanced no farther, but appeared to wait for succours; small brigades kept frequently arriving to reinforce them, which emboldened them to approach nearer to the city they had blockaded; upon this their anxiety to send couriers to their own nest seemed to increase; these spreading a general alarm, a large reinforcement immediately set out to join the besieging army; yet even then they did not begin the battle. Almost all the negroes, coming out of their fortress, formed themselves in a body about two feet square in front of it, and there expected the enemy. Frequent skirmishes were the prelude to the main conflict, which was begun by the negroes. Long before success appeared dubious they carried off their pupæ, and heaped them up at the entrance to their nest, on the side opposite to that on which the enemy approached. The young females also fled to the same quarter. The sanguine ants at length rush upon the negroes, and attacking them on all sides, after a stout resistance the latter, renouncing all defence, endeavour to make off to a distance with the pupæ they have heaped up. The host of assailants pursues, and strives to force from them these objects of their care. Many also enter the formicary, and begin to carry off the young brood that are left in it. A continued chain of ants engaged in this employment extends from nest to nest, and the day and part of the night pass before all is finished. A garrison being left in the captured city, on the following morning the business of transporting the brood is renewed. It often happens (for this species of ant loves to change its habitation) that the conquerors emigrate with all their family to the acquisition which their valour has gained. All the incursions of *F. sanguinea* take place in the space of a month, and they only make five or six in the year. They will sometimes travel one hundred and fifty paces to attack a negro colony."

Let us now turn to an account of the proceedings of slave-makers nearer home. Miss Mary Treat has given a most interesting narrative of her observations of the doings of the American red ant *(F. sanguinea)* at her home in New Jersey; the account was published in *Harper's New Monthly Magazine*, from which we extract the following description. It is the result, she says, of several weeks' close observation, to the exclusion of all other work, commencing the 1st of July and extending into August.

The nest of the red slave-makers was in a grove, and must have contained several thousand working inhabitants. About fifty feet from it was a nest of black ants (*F. fusca*), apparently fully as large and strong as that of the red ants. Externally the two nests did not differ very much. The red ants raised a slight mound, while the blacks had simple excavations about the roots of an oak tree.

"On a sultry afternoon, the 1st day of July"—to quote Miss Treat's words—"I was lazily sauntering in the grove, when, on looking down, I found to my surprise, that I was in the midst of a battle-field. A powerful army of red ants had invaded the dominions of the black colony which for three years past I had had a kind of supervision over. I had often brought plants covered with aphides—the immortal Linnæus called these aphides the ants' cows—and stuck the plants into the earth around their dwelling, and had given them sugar, and had driven and carried toads from their nest which were devouring them. In short, I had become very much interested in and quite attached to this colony, but I was powerless to aid them now. I could only look on in wonder and astonishment.

"A yard or more around the foot of the tree the battle was raging, and no place for the sole of my foot without crushing the combatants. I found in every instance a red ant pitted against a black; sometimes two red ones against one black, in which case the black was soon despatched. For three hours I watched the conflict; all around me the combatants locked in a close embrace, rolling and tumbling about, never separating until one was killed, and often the dead victim had fastened with so firm a hold on his adversary that it was with the utmost difficulty that he could free himself from his death-grip. The sun went down, and the gathering darkness compelled me to leave my post of observation; but as long as I could see, the conflict was as fierce as ever. I now picked up several of the warriors, but so intent were they in their terrible struggle that my handling did not divert them in the least. I carried several pairs into the house, placed them under a large oval glass on a marble-topped table, and watched the conflict.

"I found I had ten black and ten red warriors, not engaged in a general melee, but each intent upon killing his own adversary. It was fully an hour before the first warrior was killed—a red had at last despatched his black antagonist, and not satisfied with killing him, he tears his legs from his body and severs his antennæ. After convincing himself that he is really dead, he looks around at the other warriors which are still closely locked in their dreadful embrace, and now he hurries from one couple to another, as if to see where his services are most needed. He finds a couple whose struggles are nearly over—a black is fastened with a death grip to his adversary's foreleg. The red hero soon severs the head from the black soldier, and leaves it hanging to the leg of his dying comrade. He now goes to another couple who are still fiercely contending; he seizes the black, and now all three roll and tumble about together; but the black is soon killed, and, as in the other case, his mandibles are locked on his adversary's leg. But this time our hero does not sever the head from the black soldier, but leaves his comrade to free himself as best he can, while he goes to the assistance of a third less fortunate brother, where the black seems to have the better of his antagonist. Here a long struggle ensues, and now another red soldier has despatched his opponent, and he comes to the struggling three, moves about them in an excited manner, with his mandibles stretched wide apart, waiting his opportunity to fasten them on the black; he finds his chance, seizes him between the thorax and abdomen, and severs the body in two; but the dying black does not relax his hold of the first antagonist. and they die together.

"I now leave the fierce combatants for the night. In the morning I find that every black is killed, and four red soldiers are dead, and two others cannot long survive. The legs and antennæ and mutilated bodies of the dead warriors are strewn about, every fragment showing conspicuously on the white marble. Out of the twenty, fourteen are dead and two nearly lifeless—only four have survived. I put some drops of water and moistened sugar under the glass for the surviving heroes; two find the water and drink. I now repair to the battle-field. The struggle is over, not a black to be seen, but a column of the red invaders is emerging from a large cavity that leads to the numerous galleries and underground chambers of these industrious blacks, and each invader is carrying a larva or pupa. I follow the column, which is from four to five inches in width, to the nest of red ants before mentioned. There is a wide opening in the side of this nest, down which they all disappear and leave their burdens, and again start for more plunder. All day long these powerful marauders are engaged in this work. They carry a larva or pupa carefully, and drop it on being disturbed. But what does this mean? Every little while a red warrior comes out with a black bundle, which he carries as carefully as he does the pupa or larva. I stop him to inquire into the matter; he drops his bundle, which immediately unrolls, and lo! it is a lively black ant, apparently unhurt, and to my eye, no way different from the warrior with whom he was so fiercely fighting."

It has been generally supposed that the red ants only took captive the young of the blacks, in order that, growing up in the home of their captors, they might have no desire to escape. "But these ants certainly carried a great number of adult blacks to their nest, and I am quite sure that they did not run away, but stayed and helped to nurse and feed the larvæ. I capture several of the red marauders with their victims, and place them under the glass. The reds now pay no attention to the blacks, but simply try to make their escape. I take larvæ and lay them on a leaf, and put them under the glass also, and place moistened sugar in their reach. Very soon the blacks are feeding the helpless larvæ. I remove the glass cover; the reds immediately run away, but the blacks stay, and continue to sip the moistened sugar and feed the young. I hold a magnifying-glass over them, and find the little larvæ raise up their heads and open their mouths to be fed, very much like young birds. I now take the larvæ, together with their nurses, and place them near the nest of red ants. I soon lose sight of the nurses, but the larvæ are quickly taken into the nest by the red soldiers."

After a few days another raid is made by the red ants. "The blacks open the large entrance of the nest, dragging the material with which it is closed to one side; and now the soldiers come out in full force, and march in a straight line to a spot about thirty feet distant; here they diverge, and seem to be hunting over the ground; soon they find a small colony of blacks. The greatest excitement now prevails among the invaders; some are passing down the main entrance, while others are rushing about with extended mandibles prepared for conflict; but the blacks are escaping from another opening a few inches distant, not trying to defend their young in the least. Very soon the marauders emerge, each with a larva or pupa. Those outside, seeming satisfied that there will be no battle, quiet down and join the ranks in ravaging the nest. In less than an hour the spoils are all taken; and the marauders, not satisfied in sacking so small a settlement, again form in line and march directly to another colony a few feet beyond the one they have so recently plundered. They go so directly to this spot that it looks as if it must have been a preconcerted plan. This colony also proves to be a small one, and the inhabitants all flee, leaving the young to be captured In less than two hours the spoilers have transferred the young to their own nest; and now, apparently satisfied with their day's work, they make preparation to close the entrance—the blacks are clearing the passages which their masters have littered while carrying in their booty. As soon as the passages are cleared, a large force is engaged in closing the entrance." Many more accounts of raids upon both black and yellow ants are given by Miss Treat, but the above will suffice to prove that slave making is a recognized "institution" among the red ants. The relative position of the masters and slaves seems to vary a good deal in the case of the species already referred to. The red ants (*F. sanguinea*) appear to bear a considerable share of the work of the community, and not to be entirely dependent upon the offices of their slaves; but the russet ants *(F. rufescens)* seem to be altogether above doing any kind of work for themselves, except when they are engaged in the military operations of attacking a nest of blacks—consequently, the entire work of the colony in their case devolves upon their slaves. Huber found by experiment that the russet ants would starve, if left to themselves, sooner than take the trouble to make use of food left conveniently within their reach. He relates that he "shut up thirty of these ants in a glazed box, supplying them with larvæ and pupæ of their own kind, with the addition of several negro pupæ, excluding very carefully all their slaves, and placing some honey in a corner of their prison. Incredible as it may seem, they made no attempt to feed themselves: and though at first they paid some attention to their larvæ, carrying them here and there, as if too great a charge they soon laid them down again; most of them died of hunger in less than two days, and the few that remained alive appeared extremely weak and languid. At length, commiserating their condition, he admitted a single negro; and this little active creature by itself re-established order, made a cell in the earth, collected the larvæ and placed them in it, assisted the pupæ that were ready to be developed, and preserved the life of the neuter rufescents that still survived."

It might be supposed that the lot of the enslaved ants was a very hard and cruel one, and that their bondage would be as distasteful to them as it usually is to human slaves. But it has been clearly shown by Westwood and others that it is quite unnecessary to bestow our compassion upon them, as the work they perform is exactly that for which they were made. The labours which the slaves undertake are not arbitrarily forced upon them by the fear of punishment, but are urged upon them by the instincts implanted within them. They would have worked precisely in the same manner and with the same industry and perseverance in their own nests as in that of their captors, and the labours are undertaken as willingly in the one case as in the other. They find themselves perfectly at home in the nest of their captors, and are in every respect on terms of equality with their masters. They have no other home but that to which they have been brought, and are no more to be pitied than our domestic animals that never have freedom.

As the slaves are always neuters, it is necessary that fresh supplies should be obtained as often as the demand for workers exceeds the available material; consequently raids have to be made for the purpose at frequent intervals during the season.

5.—HARVESTING ANTS.

From the middle of the last century until a few years ago, naturalists had agreed to doubt the ancient belief, dating from the days of Solomon, that ants show forethought and husbandry in the collection and storage of seeds and grains, because they had been unable to observe that anything of the kind was done. It is now, however, satisfactorily proved by the minute observations of competent persons, especially of Dr. Lincecum, in Texas, and Mr. Moggridge, in the south of France, that certain species of ants do exhibit the foresight and providence necessary for the storing of supplies of food to carry them through the wintry or rainy seasons.

Ancient authors abound in references to the harvesting operations of ants, which no doubt were quite familiar to them. There are, for instance, the well-known passages in the Book of Proverbs, where Solomon says (vi. 6-8):—"Go to the ant, thou sluggard; consider her ways, and be wise: which having no guide, overseer, or ruler, provideth her meat in the summer, and gathereth her food in the harvest;" and again (xxx, 25):—"The ants are a people not strong, yet they prepare their meat in the summer." Horace, Virgil, Plautus, Hesiod and other classical authors, also have allusions to the foresight of the ant. Claudius Ælianus, who lived in the time of the Emperor Hadrian, gives a detailed account of the habits which he attributes to ants: "In summer time, after harvest, while the ears are being threshed the ants pry about in troops around the threshing floors, laeving their homes, and going singly, in pairs, or sometimes three together. They then select grains of wheat or barley, and go straight home by the way they came. Some go to collect, others to carry away the burden, and they avoid the way for one another with great politeness and consideration, especially the unburdened for the weight carriers. Now these excellent creatures, when they have returned home, and stored their granaries with wheat and barley, bore through each grain of seed in the middle; that which falls off in the process becomes a meal for the ants, and the remainder is unfertile. This these worthy housekeepers do, lest when the rains come the seeds should sprout, as they would do if left entire, and thus the ants should come to want. So we see that the ants have good share in the gifts of nature, in this respect as well as others. . . . . . So the ants though they need no threshing time, nor men to winnow for them, nor an artificial draught of wind to separate corn and chaff, yet have the food of men who both plough and sow for it" (Moggridge).

The following account of modern harvesting ants is taken from Moggridge's valuable and interesting work. He found four species of genuine harvesters, and carried on observations from October to May at Mentone in the south of France. In a warm and sheltered valley, a few minutes' walk from the house in which he lived, he discovered thirty nests of the most active seed-storing ants. The spot was a rough slope of soft sandstone rock, with accumulations of sandy soil in the hollows, covered with a sparse and scrubby vegetation. Cultivated lemon terraces lay on the edge of the wild ground lower down in the valley, and at that season were overgrown with a rank crop of weeds, most of which were in seed. "I had scarcely set foot on the wild ground," he relates, "before I was met by a long train of ants *(Atta barbara)*, forming two continuous lines, hurrying in opposite directions, the one with their mouths full, the others empty. About ten yards distant, partly shaded by some small bushes, lay the nest, to and from the entrance of which the incessant stream of incomers and outgoers kept flowing." The workers usually sought their harvest at some distance from the nest, going in search of it as far as the cultivated ground where the crops of weeds were more abundant and more varied. "In one case I was able to follow the thread-like column of workers from the nest to the weedy terrace, and found that the nearly continuous double line measured twenty-four yards. Even this gives but an inadequate idea of the number of ants actively employed in the service of the colony, for hundreds of them were dispersed among the weeds on the terrace, and many were also employed in sorting the materials, and in attending to the internal economy of the nest. Still this affords some evidence of the systematic and extensive scale on which foraging is carried on by this ant, and of the high importance which these creatures attach to their provision of grain."

The ants brought in not only seeds of large size and fallen grain, but also green capusles of shepherd's purse, chickweed, etc. They did not employ any materials in the construction of their nest, but simply excavated it out of the earth itself or the sandy rock; the large mounds, in great part composed of vegetable matter, frequently found at the entrances of their nests, were nothing more than the rubbish heaps of each establishment. They consisted in part of earth and grains of gravel brought from the nest during the excavation of the subterranean chambers, but principally of plant refuse, such as the chaff of grasses, empty capsules, gnawed seed-coats, and the like, which would occupy much space if left inside the nest. While an army of workers is employed in seeking and bringing in supplies, others are busy sorting the materials thus obtained, stripping off all useless envelopes of seed or grain and carrying them out to throw away.

"I selected a nest," Moggridge relates, "where the coarse and hard rock lay near the surface, compelling the ants to extend their nest in a horizontal direction. Here, almost at the first stroke, I came upon large masses of seeds carefully stored in chambers prepared in soil. Some of these lay in long sub-cylindrical galleries, and owing to the presence in large quantities of black shining seeds of amaranth, looked like trains of gunpowder laid ready for blasting. There were in this nest seeds, etc., which had been taken from more than twelve distinct species of plants, belonging to at least seven separate families. The granaries lay from an inch and a half to six inches below the surface, and were all horizontal. They were of various sizes and shapes, the average granary being about as large as a gentleman's gold watch."

"I was greatly surprised to find that the seeds, though quite moist, showed no trace of germination, and this was the more astonishing, as the self-sown seeds of the same kinds were then coming up abundantly in gardens and on terraces." In order to investigate this matter thoroughly he collected and carefully examined large quantities of the grain and seeds taken at different times from the stores of twenty-one distinct nests, the first of which was opened on October 29th, and the last on May 5th. In these twenty-one nests, out of the thousands of seeds taken, he only found twenty-seven in seven nests which showed trace of germination, and of these eleven had been mutilated in such a way as to arrest their growth. Yet the vitality of the seeds was not destroyed, as he proved by raising crops of various weeds from seeds taken out of these granaries.

"When the seeds do germinate in the nests," he relates, "and it is my belief that they are usually softened and made to sprout before they are consumed by the ants, it is very curious to see how the growth is checked in its earliest stage, and how, after the radicle or fibril—the first growing root of dicotyledonous and monocotyledonous seeds—has been gnawed off, they are brought out from the nest and placed in the sun to dry, and then after a sufficient exposure, carried below into the nest. The seeds are thus in effect malted, the starch being changed into sugar, and I have myself witnessed the avidity with which the contents of seeds thus treated are devoured by the ants."

In an appendix, Mr. Moggridge gives corroborative testimony from other observers, from which the following extracts are taken. Lieut. Colonel Sykes, in his descriptions, of new Indian ants, relates: "In my morning walk at Poonah, June 19th, I observed more than a score of little heaps of grass-seeds in several places, on uncultivated land near the parade ground; each heap contained about a handful. On examination, I found they were raised by a species of ant *(Atta providens)*, hundreds of which were employed in bringing up the seeds to the surface from a store below; the grain had probably got wet at the setting in of the monsoon, and the ants had taken advantage of the first sunny day to bring it up to dry. The store must have been laid up from the time of the ripening of the grass-seeds in January and February. As I was aware this fact militated against the observations of entomologists in Europe, I was careful not to deceive myself by confounding the seeds of a *Panicum* with the pupæ of the insect. Each ant was charged with a single seed, but as it was too weighty for many of them, and as the strongest had some difficulty in scaling the perpendicular sides of the cylindrical hole leading to the nest below, many were the falls of the weaker ants with their burdens from near the summit to the bottom. I observed they never relaxed their hold, and with a perseverance affording a useful lesson to humanity, steadily recommenced the ascent after each successive tumble,nor halted in their labour until they had crowned the summit, and lodged their burden on the common heap."

"On the 13th of October of the same year, after the closing thunderstorms of the monsoon, I found this species in various places similarly employed as they had been in June preceding; one heap contained a double handful of grass-seeds. It is probable that the *Atta providens* is a field species of ant, as I have not observed it in the houses."

Dr. Jerdon, in a Madras journal, gives a somewhat similar account of the same ant, stating that it digs up small garden seeds immediately after they are sown, and carries them off to its nest, to the great annoyance of the gardener. Mr. Home gives an account of similar observations in another part of the East, and Mr. Buchanan White records the harvesting performances of a colony of ants at Capri. With all this testimony we cannot but believe that the ancients were right and modern European entomologists wrong as regards this interesting characteristic of these species of ants.

Miss Mary Treat, whom we have already quoted, gives, in a paper communicated to *Lippincott's Magazine*, a very graphic and interesting account of her observations on harvesting ants in Florida. Their nests are abundant in the low pine barrens of that State, and consist externally of a little mound, surrounded by a circle of small chips and bits of charcoal, often brought from some distance; the mounds are regular in outline, with a crater-like depression on the summit, in the centre of which is the entrance. Their colour is reddish brown, and they are furnished with stings, which inflict about the same amount of pain as that caused by honey bees. There are three sets of neuters in each colony—major and minor workers and soldiers, and one wingless queen.

"Early in December, 1877," Miss Treat relates, "I brought a large colony of these ants from one of the hills, including the workers, major and minor, and soldiers, and established them in a glass jar which I placed in my study. They very soon commenced work, tunnelling the earth and erecting a formicary, as nearly as they could after the pattern of their home on the barrens. The mining was done entirely by the small workers. At first they refused all animal food, but ate greedily fruit and sugar; and all kinds of seeds which I gave them were immediately taken below, out of sight. I now visited the mounds on the barrens, and found abundant indications of their food supplies. At the base of each mound was a heap of chaff and shells of various kinds of seeds. The chaff was of *Aristida speciformis*, which grew plentifully all about. I also found many seeds of *Euphorbia* and *Croton*, and several species of leguminous seeds. But the ants were not bringing seeds in at this time of the year; they were only carrying out the discarded seeds and chaff; and only on the warmest days were they very active. But they do not wholly hibernate. Even after a frosty night, by ten o'clock in the morning many of the hills would be quite active.

"On excavating a nest, I found chambers, or store-rooms, filled with various kinds of seeds. But, so far as I have observed, the seeds are not eaten until they are swollen or sprouted, when the outer covering bursts of itself. At this stage the starch is being converted into sugar, and this seems to be what the ants are after. They also seemed to be very fond of the yellow pollen-dust of the pine. The catkins of the long-leaved pine commenced falling in February, and I noticed ants congregated on them; so I took those just ready to discharge the pollen, and shook the dust on the mound in little heaps, which were soon surrounded by ants, crowding and jostling each other in their eagerness to obtain a share.

"The colony in the glass jar seemed perfectly contented, not trying to make their escape at all. The earth was originally a little more than two inches in depth, but by the first of February these wonderful architects had reared their domicile to the height of six inches. They raised tier upon tier of chambers in so substantial a manner that they never fell in. One of the store-rooms in which they deposited the seeds I gave them was at the bottom of the jar, and the seeds were stored against the glass with no intervening earth between; it contained about a teaspoonful of millet. I gave this chamber the right degree of heat and moisture to sprout the seed by pouring a little water down the side of the jar until it penetrated the chamber, and then setting it near the fire. The ants soon appreciated the condition of this store-room, and many congregated there and seemed to be enjoying a feast. The next day the seeds were all brought to the surface and deposited in a little heap on one side of the jar, where many of them grew, making a pretty little green forest, which the ants soon cut down and destroyed. This chamber remained empty for three or four days, and was then again filled with fresh millet and apple and croton seeds."

On excavating some nests of the same species *(Atta crudelis)* in their native haunts on the barrens, she found granaries of seeds scattered irregularly throughout to the depth of twenty-two inches below the surface of the ground; some were near the surface, and a few scattered about in the mound had sprouted. The mound is usually not more than four to six inches above the level of the ground.

"The great majority of nests," she adds, "that I have found are in the low pine barrens—so low that on reaching the depth of two feet the water runs into the cavity like a spring, and stands above some of the granaries. Notwithstanding this wet locality, I found no sprouted seeds in the deeper store-rooms, but only in the warmer mound. On sunny days the larvæ are brought up into the mound and deposited in chambers near the surface, where they receive the benefit of the sun's rays. On cool, cloudy days and in the early morning I found no larvæ near the surface. If the ants are intelligent enough to treat the larvæ in this way, why should they not store seeds where they will not sprout? And when they need to sprout them in order to obtain the sugar they contain, it would take no more wisdom to treat the seed as they do the larvæ—bringing them near the surface to obtain the right degree of heat for the required result."

6.—How to Get Rid of Ants.

As we have now almost exhausted the space allotted to us for this subject, we shall close with the mention of a few modes of getting rid of ants, as no doubt they are more familiar to our readers as domestic pests than in the interesting character described above. We find that we must leave over to another year any account of many other varieties of ants, such, for instance, as the dreaded driver ants of Africa, the agricultural ants of Texas, the leaf-cutting and foraging ants of Central and South America, (see figs. 71, 72 and 73), the honey ants of Mexico (see fig. 74) and other remarkable species. We must also postpone any description of the wonderful works of ants, in road-building, tunnelling, well-digging, etc., their care of aphides, domestic life, intelligence, language and other particulars, which, we have no doubt, are of great interest to all lovers of natural history.

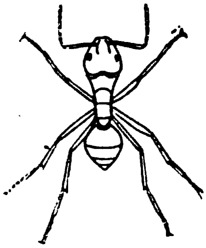

Fig. 71.

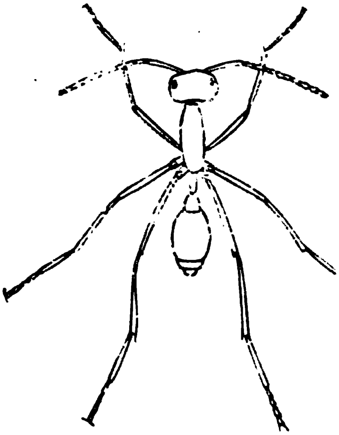

Fig. 72.

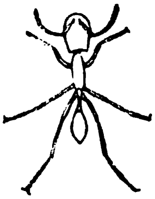

Fig. 73.

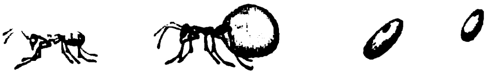

Fig. 74.

Fig. 71, Worker Major (*Polyrhachis arboricola*). Fig. 72, Worker Minor (*Eciton Mexicana*). Fig. 73, Worker Minor (*E. Sumichrasti*). Fig. 74, the Honey Ant of Mexico (*Myrmecocystus mexicanus*).

Numerous, and not uncalled for, are the complaints that house-keepers make in this country respecting the inroads upon their sugar and preserves and other goodly stores, by the swarms of little ants that infest our houses in the summer time; but the annoyance caused by these tiny creatures in this country cannot for a moment be compared with the fearful ravages they often commit in hot climates. The following are some modes recommended for their destruction when they come into the house:—(1) Take a coarse sponge, damp it slightly, and then dust over and into it some finely pulverzed sugar; lay the sponge in the place that they most frequent, removing for the time any sweets that they usually attack. In a very short time the sponge will be found full of ants; dip it in boiling water, squeeze out the dead bodies, and repeat the operation. A little perseverance will exterminate the pests. (2) A somewhat similar plan is to lay fresh bones around their haunts; they will leave everything else to attack them. When thus accumulated, destroy as before by dipping in hot water. (3) Another plan that has been found effective, but we do not recommend it owing to the danger arising from any carelessness in its use, it is to put arsenic or Paris green in highly sweetened water, and set the vessel in their way. It is said that in two or three days no more will be seen. (4) When ants are troublesome in flower-beds or lawn they may be destroyed by pouring very hot water copiously into their nests, or by using coal-oil in the same way; a few tablespoonfuls is said to suffice for the destruction of a nest. (5) The burying of a few sliced onions in the nest is said to cause them to abandon their quarters; but if so, they may remove to an equally unsatisfactory position. (6) Carbolic acid and corrosive sublimate are said to be especially poisonous to ants, the latter substance rendering them actually insane, if such an expression may be used of these creatures. Among natural checks may be mentioned the ant-lions (*Myrmeleo*), which dig pits for the capture of the ants, at the bottom of which they lie in wait for their victims, toads, and some species of birds.

4970. Mar. 1. 1882.

ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF THE

PROVINCE OF ONTARIO,

FOR THE YEAR

1881.

H. Hagen.

Printed by Order of the Legislative Assembly.

Toronto:
PRINTED BY C. BLACKETT ROBINSON, 5 JORDAN STREET.
1882.

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TWELFTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

INCLUDING REPORTS ON SOME OF THE NOXIOUS, BENEFICIAL AND OTHER INSECTS OF THE PROVINCE,

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE, BY THE OFFICERS AND MEMBERS OF THE SOCIETY.

1881.

To the Honourable the Commissioner of Agriculture:

SIR,—In accordance with our Statute of Incorporation, I have the honour to submit to you the Report of the Entomological Society for the year 1881.

The Report includes the audited Financial Statement and the Transactions of the annual meeting for the election of officers and general business, which was held at the City of London on September 24th, 1881. I have also the honour to submit for your approval illustrated reports on the life history and habits of various insects, which have been prepared by members of the Society for the information of the general public, and more especially of those interested in the productions of the soil.

The liberality and fostering care of the Ontario Government during the last twelve years, in aiding our Society by an annual grant, has stimulated the efforts of our practical entomologists, and a reference to the Annual Reports furnished to your Department will show that the Society has faithfully endeavoured to prove of some real benefit to the public interests. The many kind expressions of approval, and the continued courteous support and assistance which we have received from yourself and your predecessors in the Department of Agriculture have been most cordially appreciated, and I feel assured that the members of the Society will always most cheerfully render the Department all the assistance in their power to promote the interests of the great agricultural community of the Province.

It is a matter of thankfulness that during the past year the country has escaped the serious ravages of any special insect pest.

I have also to report for your information that the Society still continues the regular publication of its monthly periodical—the *Canadian Entomologist*—which has now reached its thirteenth volume.

The library has been largely increased, and the acquisition of a valuable microscope has very materially added to the capabilities of the Society for scientific investigations.

I have the honour, Sir, to remain,

Your obedient servant,

EDMUND BAYNES-REED,

Secretary-Treasurer.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The annual meeting of the Society was held, according to announcement, in their Rooms, Victoria Hall, Clarence Street, London, Ontario, on Monday evening, September 26th, 1881.

A number of those interested in Entomology were present from different parts of the Province—the President, Mr. Wm. Saunders, in the chair. Letters of apology for non-attendance were read from Rev. C. J. S. Bethune, Port Hope; Jas. Fletcher, Ottawa; W. H. Harrington, Ottawa; W. Couper and G. J. Bowles, Montreal.

The Report of the Council was read and adopted, also that of the Montreal Branch, and the Secretary-Treasurer submitted his Financial Report, duly audited, which was also adopted.

ANNUAL STATEMENT OF THE SECRETARY-TREASURER OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE YEAR ENDING SEPTEMBER 24TH, 1881.

Receipts.

Balance from previous year, 1880	$354 80
Members' fees, sale of *Entomologist*, etc.	294 23
Government grant, 1880	1000 00
Merchandise: pins, cork, etc.	31 38
Sale of Cabinet	4 00
Interest	21 77
Engraving—received for electrotypes of cuts	55 70
	$1,761 88

Disbursements.

Canadian Entomologist; printing, paper, stationery, etc.	$476 55
Library and apparatus	551 82
Expenses of Report for 1880, including engraving, electrotypes and woodcuts	265 90
Annual vote to Editor and Secretary	150 00
Rent	80 00
Insurance	6 35
Expenses of delegation to A. A. A. S.	32 00
Bookcase for Library	60 00
Sundries: postage, etc.	65 34
Balance	73 92
	$1,761 88

We have examined the above with books and vouchers, and found the same correct. Balance in hand, seventy-three dollars and ninety-two cents ($73.92).

CHARLES CHAPMAN,
ABRAHAM PUDDICOMBE, } *Auditors.*

London, Ontario.
September 24th, 1881.

REPORT OF THE COUNCIL FOR THE YEAR 1881.

Once again, at the close of another year, it becomes the duty of your Council to report on the state and condition of the Entomological Society of Ontario. It is with pleasure that we feel ourselves able to bear witness to the continued activity, progress, and usefulness of our Society. Our roll of membership is still being constantly augmented by new and valued additions, and the interest in the special work of the Society is more and more widely diffused, not only in our own Province and Dominion, but in the wider circles of the adjoining Republic, as well as in the various countries of the European continent. The publication of the *Canadian Entomologist* is maintained as of yore, and under the able management of its Editor, our worthy President, and with the assistance of its numerous contributors, our periodical continues its useful work of adding to our store of entomological knowledge, and distributing far and wide the results obtained from much hard work and patient observation.

The Annual Report receives the approval of those for whose benefit it is written, and adds an additional proof of the Society's vitality. We are therefore able to state that the work of the Society has been productive of much good, and by its quiet, unobtrusive way has aroused the attention of many whose interests can be materially affected by an acquaintance with the practical results of entomological science. We commend this study to the thoughtful consideration of every farmer, gardener, and fruit-grower, and we feel convinced that the day is not far distant when some knowledge of Entomology will be a necessary part of the education of every tiller of the soil. During the year a large addition has been made to the Library, which now numbers some 550 volumes. Arrangements have been made for a catalogue, and we hope that each succeeding year will add greatly to the number and value of this important property of the Society.

Your Council also availed themselves of an excellent opportunity to procure a valuable microscope, which will be found a most useful adjunct to the Society's rooms, and be of inestimable service in our entomological work.

The Montreal Branch is still flourishing, and their Annual Report will, as usual, be submitted to you.

The London Branch, after due deliberation, decided this year to suspend its operations, and merge its work and membership in the parent Society so long as London was the headquarters of the Society. This has, we are glad to say, been a source of strength to the parent Society. Regular monthly meetings have been kept up, and a greater degree of interest aroused. The audited Report of our financial operations will, as usual, be laid before you by the Secretary-Treasurer.

E. BAYNES-REED,
Secretary-Treasurer.

MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Eighth Annual General Meeting of this Branch was held at the residence of Mr. Geo. J. Bowles, Montreal, on Tuesday, 8th of May, 1881, at 8 o'clock p.m.

The President read the following Report of the Council:

EIGHTH ANNUAL REPORT.

Your Council, at the end of the eighth year since the organization of the Branch, beg to present their Annual Report.

Eight very pleasant meetings have been held during the year, and the interest of the members in the Society has been well kept up. Four new members have been added to the list during the year.

Your Council would record with regret the loss of our indefatigable Secretary, Mr. G. H. Bowles, who in February last removed from this city to reside in Chicago.

The following papers have been read before the Society during the year:

1. "Remarks on *Papilio Brevicauda.*"—By W. Couper.
2. "The Mouth Parts of some Carnivorous and Wood-eating Beetles," with illustrative drawings.—By G. H. Bowles.
3. "Notes on the *Coleoptera* of the Island of Montreal, Part I."—By F. B. Caulfield.
4. "Notes on the Species of *Callimorpha* occurring on the Island of Montreal."—By F. B. Caulfield.
5. "List of *Lepidoptera* taken by Dr. Robert Bell, in 1880, in the North-West Territory."—By H. H. Lyman.

Also a paper by the Rev. T. W. Fyles, entitled, "Advice to Farmers, and How to Deal with the Potato Beetle."

The following works have been added to the Library during the year:

Cassino's Naturalist's Directory for 1880.
The *American Entomologist* for 1880.
Psyche for 1880.

The Financial Statement for the year is herewith submitted.

In conclusion, your Council would record with pleasure the satisfactory state of the Society, and would express the hope that with the accession of new members the work of the Society will be prosecuted during the coming year with even more zeal and perseverance than in the past.

The whole respectfully submitted.

(Signed) GEO. JOHN BOWLES,
President.

The Report having been adopted, and two new members elected, the meeting proceeded to the election of officers for the year, with the following result:

H. H. Lyman, M.A., President; W. Couper, Vice-President; G. J. Bowles, Secretary and Treasurer; Geo. Bowles, Curator; Robert Jack, F. B. Caulfield, and Robert Burland, Council.

Two papers were then read, namely: "Notes on Some Species of *Hymenoptera* occurring at Montreal," by F. B. Caulfield; and one "On Instinct in Insects," by G. J. Bowles.

The meeting then adjourned, having spent a most agreeable evening.

G. B. Pearson, Jr.,
Secretary pro tem.

The President then delivered his annual address, on the conclusion of which the meeting unanimously tendered Mr. Saunders a vote of thanks, with a request that his address be printed in the *Canadian Entomologist.*

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

To the Members of the Entomological Society of Ontario:

Gentlemen,—While Entomology may be said to deal with small things, the abundance or scarcity of the tiny creatures called insects involves great issues. The truth of this statement has been illustrated forcibly in several directions this year, notably in the case of the Angoumois wheat moth, which has played sad havoc among the stores of corn and wheat in granaries in the South-western States. It is said to have destroyed many thousand bushels of grain, and so widespread has the evil become that it is the opinion of the New York *Sun* that if the Government or the farmers of America could at this time arrest the progress of this insect by expending five millions of dollars, it would be the best investment ever made by the people.

The Angoumois grain moth, *Butalis cerealella* Oliv., is a small moth, the larva of which is very destructive to all sorts of grain. The female lays her eggs on the grain sometimes in the field before it is fully ripened, but more frequently in the bins in the granary. The eggs are of a bright orange red colour, and in a few days there issue from them very minute whitish-coloured worms, scarcely thicker than a hair, which bore into the grain and occupy it, one larva in each kernel. Each kernel contains sufficient food to support one occupant until it reaches maturity, when it changes to a chrysalis within the grain, which, although hollowed and almost entirely consumed within, appears outwardly sound and plump. On pressing between the fingers the grain is found to be soft and yielding, and when dropped into water it floats on the surface.

When the larva is full grown it spins a white silken cocoon, which occupies one end of the cavity within the grain, the other end being filled with the castings of the worm. The moth makes its escape through a small round hole in the side of the grain, which the larva cuts with its jaws before spinning its cocoon. When preparing this orifice for the escape of the future moth, the larva is careful not to cut entirely through, but leaves a thin tissue-like skin unbroken, which the moth finally ruptures when it makes its escape. The body of the moth is about one-third of an inch long, and its wings when spread measure about two-thirds of an inch across; the fore wings are of a plain brownish-buff colour, with a satin-like lustre; the hind wings above and below, as also the under side of the fore wings, are blackish-grey.

This insect is a native of the warmer parts of Europe, and has long been very destructive in France. It was introduced into the southern portion of the United States more than 100 years ago, where it has become fully naturalized. It is often brought into New York in cargoes of grain, but the climate of the Northern United States and Canada appears to be too cold to permit it to thrive amongst us, or to permanently establish itself. It has never yet, to my knowledge, been found within the limits of our Province.

The Chinch Bug, which, although always present in our midst, has happily never yet proved a serious trouble with us, has been very destructive to the corn crop in Missouri and Kansas, and combined with the drought, has seriously affected the yield of this cereal in those States.

The Army Worm has appeared during the season in some portions of the West, and inflicted much damage; and there were good reasons for anticipating trouble from this source in our own Province next year, unless the exceptional drought we have lately experienced, and which has been generally looked upon as an unmitigated evil, should check their natural increase. The Army Worm, in common with many other of our night-flying moths, is double-brooded, but whether the later brood pass the winter in the larval or chrysalis state has never been fully settled. It is probable that with us the bulk of the brood pass the inclement season in the larval condition, the young larva burrowing into the ground for protection during the extreme cold of winter. It has been observed by Entomologists that an unusually wet season, which induces a free growth of vegetation, is very favourable for the sustenance of these pests, and if preceded by a dry autumn, which appears to have the effect of disseminating the moths over a wider area, the worms are often met with in great abundance. During this summer the Army Worm moths *(Leucania unipuncta)*, which are always present with us to a greater or less extent, have been unusually abundant in the western portion of our Province. To the sugar-bait, employed by Entomologists to attract night-flying moths, these insects have flocked by hundreds, and this has been observed not only in Ontario, but also in the Western States, showing that this moth has been unusually abundant over an extended district. Millions of their eggs must have been deposited on the leaves and stems of grasses, but the intense drought we have had has probably deprived the newly-hatched larvæ of the food necessary to their existence, and we may hope that the evil we have suffered from in the way of drought has saved us to a great extent from serious invasions of Army Worms next year.

Much attention has been paid of late by Entomologists to the natural conditions which favour or prevent the increase of injurious insects; and I think there is good ground for expecting, after a few more years of close observation, that it will not be difficult to prognosticate, with a large measure of accuracy, several months in advance, the probabilities as to the insect pests likely to prevail during any year in any given district. When this can be satisfactorily accomplished, much practical good may be expected to result therefrom, since by avoiding the planting of such crops as are likely to be especially injured by insect hosts, and growing others comparatively free for the time from these troubles, a large saving may be effected.

During the summer a small moth, well known to Entomologists as a common insect throughout the Northern States and Canada, but never before recorded as destructive anywhere, has invaded the pastures in some parts of Northern New York, and inflicted great injury. It is a species of Crambus, *Crambus vulgivagellus*. The Crambidæ are known by the common name of grass moths, from the fact that as far as is known they all feed in the larval state on grass, and hence the moths are found everywhere in meadows, flying about in the daytime, with a short but rapid flight. The moths are small, with narrow front wings, which are usually ornamented with metallic spots and stripes. It was about the middle of May that a serious invasion of what was popularly supposed to be the Army Worm occurred in St. Lawrence County, New York. The State Entomologist, Prof. J. A. Lintner, at once visited the scene of destruction, and found the injury widespread and serious, extending over eight of the northern counties. Hundreds of acres of grass presented a brown appearance, as if winter-killed. A pasture lot of ten acres, which ten days before offered good pasture, was so thoroughly destroyed that in many places not a blade of grass could be seen to the square yard. The upland pastures were first attacked, and entire fields were laid waste in ten or twelve days. Unlike the Army Worm, the caterpillars were seldom seen, and never observed actively feeding, and it was believed by the farmers that they fed at night, or by drawing the blades of grass into their subterranean retreats. In two instances the larvæ were observed in immense numbers collected on the trunks of trees, so that they could have been scooped up by handfuls. The cause of their congregating at these points could only be conjectured; it was not for feeding on the foliage, for the grasses alone are their natural food. The caterpillars were slender, cylindrical worms, about three-quarters of an inch long, of an obscure greenish colour, with shining black heads. They were destitute of lines or other ornamentation, excepting some small, warty spots on their upper side. Early in August the moths began to appear, when they were identified as specimens of *Crambus vulgivagellus*, the new enemy proving to be an inconspicuous and hitherto unobtrusive little Crambus. It is quite probable that several accounts of injuries to pasture lands in the New England States during the last three or four years by some unknown depredators are to be credited to this species.

At a late meeting of our Entomological Society, held in London, one of our members, Mr. J. M. Denton, referred to the injuries which were at that time being inflicted on some pasture lands within a few miles of London by the larva of the common May Bug *(Lachnosterna fusca)*, and exhibited specimens of their work. He had found whole fields of pasture land with the roots of the grass so eaten that the turf could be readily lifted with the hand by the yard, and underneath were thousands of these grubs feeding on the remaining fragments of roots. In one instance, near the village of Delaware, a field had been so completely destroyed that the farmer had set fire to the withered grass with the hope of scorching the enemy to death. As these larvæ readily burrow in the ground when disturbed, he was advised to adopt a different method and turn his hogs into the field to root amongst the grass and devour the larvæ, which they greedily consume in immense numbers. Such wholesale destruction by this insect is not common, but when it does occur it is very alarming.

In the tenth annual report of the State Entomologist of Illinois, just received, mention is made of a new insect injurious to corn. This is a small beetle closely allied to the common striped Cucumber Beetle, and known to Entomologists under the name of *Diabrotica longicornis.* In Illinois the damage caused by the larva of this insect has been considerable. They are small white worms about half an inch long and very slender, which attack the fibrous roots of the corn, and so destroy them that the plants may be pulled up very easily with the hand. After a time the plants begin to wither and the grain fails to mature. In some instances it is believed that the injury inflicted by this tiny creature would result in the loss of fully one-third of the crop. The perfect beetle is about one-fifth of an inch long, with a width scarcely equal to half its length, and of a pale, dull greenish yellow colour without spots or stripes.

The general alarm which prevailed several years ago in reference to the Colorado Potato Beetle seems now to have to a great extent subsided, and notwithstanding that the insect has been very abundant in some sections, it has not been so generally injurious, and where it has appeared in abundance prompt remedial measures have been successfully employed. It has been claimed, and, I suppose, correctly so, that this pest originally came from the canons in the Rocky Mountains, in the State of Colorado, where it is said to have fed on some wild species of Solanum growing there. It was my privilege during the latter part of August of this year to spend a week in this district, and while there I travelled fully one hundred miles through those canons. Several species of wild Solanum grow in abundance almost everywhere, in the adjoining plains as well as in the canons, and every opportunity was embraced of examining them, but in no instance could I detect any evidence of the presence of the Colorado Potato Beetle in any of its stages. Besides, I saw several potato patches, and these also seemed quite free from any insect trouble. This seemed to me not a little singular in view of the extremely prolific nature of the insect. Can it be that it has migrated so completely as to leave over large areas no representatives behind? or have its natural enemies so increased as to almost annihilate the pest? Our farmers here would, I am sure, gladly hail the advent of either of these agencies should it free them from this troublesome insect.

The question of the use of the most suitable and economical poisons for the destruction of injurious insects still attracts much attention, and Paris Green continues to head the list as the most generally useful, notwithstanding the efforts which have been made by interested parties to replace it by London Purple. London Purple is an arsenical mixture, a waste product, which accumulates during the manufacture of aniline dyes. Before its introduction as an insect destroyer it had no commercial value; on the contrary, the dye makers were at considerable expense and trouble in getting rid of it as it accumulated. Arsenic, which is the active ingredient in this compound, is present in very variable proportions, which is just what one might expect in a waste product. Sometimes it forms less than twenty per cent. of the mixture, while other samples will contain more than forty per cent. It is associated chiefly with lime and colouring matter. The arsenic present is in a very fine state of division, and intimately mixed with the lime and other ingredients, forming a very fine powder. It is much more soluble than Paris Green, and hence more liable to scorch the foliage, while its very variable strength makes it uncertain in its effects. For these reasons London Purple is not likely to take the place of Paris Green as an insecticide, which, when unadulterated, is nearly uniform in its composition and effects. An artificial mixture of arsenic and lime of uniform strength and coloured could be supplied at about the same price, and would be more reliable than London Purple; but, owing to the more ready solubility of the arsenic in this form and its caustic character, it is apt, unless used with much care, to destroy portions of the tissues of the leaves on the plants to which it is applied, making them appear as if scorched or burnt.

Experiments have been carried on for the past two seasons at the Agricultural College at Lansing, Michigan, by Prof. A. J. Cook, on the use of London Purple as a remedy for the Codling Worm. Early in the summer, while the fruit was quite small, some crab apple trees were syringed thoroughly with London Purple mixed with water, and it is claimed that the poison, which, when the water has evaporated, forms a thin coating on the fruit, either prevents the Codling Moth from depositing her eggs or else poisons the young larvæ as soon as they are hatched, the result being the saving of a very large proportion of the crop from injury, while other trees near by not similarly treated bore very wormy fruit. It is also said that, as the fruit approaches maturity, the most delicate chemical tests fail to show a trace of the poison. I scarcely think that the experiments yet tried in this direction have been sufficiently extended to warrant any general conclusions being based on them; and provided it were proven that this remedy was a certain and safe one, the popular prejudice against applying such virulent poisons directly to the fruit we are to eat would be so strong as to prevent the general use of any such means. Indeed, were it generally known that the apple growers of any district were in the habit of applying arsenic in any form directly to their fruit, it would interfere very seriously with their sales, and it is doubtful if apples so treated would find a ready market anywhere.

It is well known that the seeds of certain noxious weeds will sometimes lie dormant in the soil for almost any number of years, awaiting a favourable opportunity for germinating; but it is not so generally known that the development of insect life is sometimes similarly retarded. It has many times been observed that a few individuals out of a large brood of moths will remain in the chrysalis state over one season and produce the perfect insect the following year, thus remaining a full year more in the dormant condition than is usual; and instances are on record where the perfect insects have escaped after three years spent in this condition of torpor. Recently, Prof. Riley, of Washington, has called attention to a very remarkable case of retarded development in the eggs of the destructive Rocky Mountain Locust, *Caloptenus spretus*. These eggs were laid in 1876, on the grounds of the Agricultural College at Manhattan, Kansas. While grading the ground around the chemical laboratory in the autumn, a quantity of eggs were buried some ten inches below the surface, the covering material being clay, old mortar, and bits of stone, and above this a plank sidewalk. On removing and regrading the soil last spring a number of these eggs were disinterred quite sound and fresh-looking, and when exposed to normal influences they readily hatched; so that these locusts' eggs actually remained nearly four years and a half in the ground unhatched, or four years longer than is their wont. How much longer they would have retained their vitality under favourable conditions of temperature and dryness is unknown. This point has a very practical bearing and deserves further investigation, not only in reference to the eggs of this insect, but to those of all injurious species whose eggs are deposited on or under the ground.

The Sub-section of Entomology of the American Association for the Advancement of Science met this year at Cincinnati, Ohio, where I had the honour of representing our Society. A large number of distinguished Entomologists were present, and many useful papers read and discussions held at the meetings. An account of the proceedings will appear in our Annual Report. It having been decided to hold the next meeting of the American Association in Montreal, I trust that our representative men in all departments of science will be present to greet with a hearty welcome the distinguished scientists from the United States and abroad who will on that occasion honour the Dominion with their presence. I have strong hopes that the Entomologists of Canada will turn out in good force.

If the progress of a science is to be indicated by its literature and the number of its devotees, then Entomology has made very rapid progress within the last two or three years. There are on this continent now nearly 500 persons pursuing the study of this important branch of natural history, and during the past year a large number of original papers have been published on the subject. The *Canadian Entomologist*, the monthly organ of our Society, continues to hold its place in the front rank among the most useful periodicals in this connection, while clustering around it now are *Psyche*, the organ of the Cambridge Entomological Club; the *Bulletin* of the Brooklyn Entomological Society; and last, though by no means least, *Papilio*, a journal devoted exclusively to lepidoptera and mainly to descriptions of new species, which has now completed its seventh number. All these are devoted exclusively to Entomology, and will be found of great value to every Entomologist. To these must be added the valuable reports of the U. S. Entomological Commission, whose good work is still being continued; the annual reports of the Entomologist of the Department of Agriculture at Washington, those of the several State Entomologists, the anual report of our own Society, as well as a large number of papers on the subject to be found in the Transactions and Proceedings of all Natural History Societies. There has also appeared in the *Canadian Sportsman and Naturalist*, edited by William Couper, of Montreal, some Entomological items of special interest to Canadian Entomologists.

In my last annual address I referred to the appointment by the Ontario Government of a Special Commission to enquire into the agricultural resources of the Province, and the progress and condition of agriculture therein. In view of the important bearing of Entomology on successful agriculture, the Government was pleased to appoint your President as one of the Commissioners. The report of the Commission has since been compiled and published, in which the insects injurious to the farmer and fruit-grower have been fully dealt with; also the remedies suggested for their destruction, and the beneficial insects which prey upon them. The evidence relating to the subjects of insects and insectivorous birds occupies 104 pages in the full report, and 61 pages in the condensed report, both of which are adorned with many excellent illustrations. The eagerness with which these publications have been sought after is indicative of the estimation in which they are held by the public. It would, I think, meet a strongly felt want if some arrangement were made whereby this valuable work, so useful to every farmer, might become accessible by purchase to all who are seeking for it throughout the length and breadth of our Dominion.

I have the honour to be,
Yours very sincerely,
WM. SAUNDERS.

The election of officers then took place, when the following gentlemen were declared duly elected:—

President.—Wm. Saunders, London.

Vice-President.—G. J. Bowles, Montreal.

Secretary-Treasurer and Librarian.—E. Baynes-Reed, London.

Council.—Rev. C. J. S. Bethune, Port Hope; J. A. Moffat, Hamilton; James Fletcher, Ottawa; R. V. Rogers, Kingston; J. M. Denton, London; W. H. Harrington, Ottawa; and W. Couper, Montreal.

Editor.—Wm. Saunders.

Editing Committee.—Rev. C. J. S. Bethune, J. M. Denton, E, Baynes-Reed.

Auditors.—Chas. Chapman, H. Bock.

The report of the Montreal Branch was next read.

Routine business having been transacted, the Chairman invited discussion on any Entomological matters.

POTATO BEETLE.

Prof. J. T. Bell, of Belleville, remarked that he had found the Potato Beetle feeding in his neighbourhood on the "Bittersweet," *Solanum dulcamara.*

Mr. Saunders stated that during his recent visit to Colorado, although he travelled much over the plains and through the mountain canons, he found no traces of this insect in any of its stages.

Mr. Chas. Arnold, of Paris, said that in his section the Colorado Beetle, after having devoured the potato vines, attacked the tomato plants.

Mr. P. C. Dempsey, of Trenton, stated that he had preserved his tomato vines from injury by the beetle by the free use of Paris Green on his potato plants.

Mr. J. A. Moffat, of Hamilton, stated that he had observed serious injury to be caused to the young plants by the beetle.

Mr. Saunders reported that *Lebia grandis*, one of the beneficial insects which devour the larvæ of the Colorado Beetle, had been found by him in greater numbers than usual, and that he had taken a number of specimens at night while sugaring for moths. Mr. Moffat had also observed it to be common near Hamilton, on the Golden-rod *Solidago.*

COTTON WORM.

Mr. Jas. Fletcher had written to ask if any member had made any observations during the year on the moth of the Cotton Worm, *Aletia argillacea*, in reference to which an interesting discussion took place at the last annual meeting.

Mr. Moffat reported having captured several specimens, and Mr. Reed had observed their frequent occurrence, attracted by light in the house at night during September.

CABBAGE BUTTERFLY.

Mr. Saunders reported that as far as he could ascertain, the extreme western limit of this insect did not at present exceed 100 miles west of Chicago.

Prof. Bell stated that he was of opinion that in the neighbourhood of Belleville the common English sparrow had proved useful in destroying the larvæ of this butterfly.

The chairman, Mr. Saunders, remarked that this was contrary to the experience of all those who had made a special study of the habits of this sparrow, and enquired whether the Professor had ever examined the crop of the bird for evidences of the presence of this larva, to which the Professor replied in the negative.

A RARE BEETLE.

Prof. Bell exhibited several specimens of *Alaus gorgops*, one of which he had captured near Belleville; and showed the peculiar points of difference between this insect and our common Eyed Elater, *Alaus occulatus.*

NEW CLOVER INSECT.

Mr. Wm. Weld, editor of the *Farmer's Advocate*, said that he had lately read in several American papers accounts of the ravages of a new clover insect; that specimens of clover heads had recently been sent him by several correspondents, infested with an insect which he believed to be this new species; and asked whether any of the Entomologists present could give him any information as to where it had occurred, and the amount of damage it was likely to cause in this Province.

Mr. Arnold thought, from what he had heard from those growing clover in his vicinity, that this insect was injuring the crop there. Mr. Saunders said that the insect had not yet come under his observation, and that he would be very glad to receive specimens from any person who should find them in this Province.

The insect referred to is the Clover Midge, *Cecidomyia leguminicola*, a small fly which in its larval state devours the ripening seeds in the clover heads.

PEA BUGS.

Mr. Weld also inquired as to the experience of those present as to the ravages of this pest during the year.

Mr. Arnold said that the Pea Bug had committed more damage this year in his neighbourhood than ever before. Some friend had recommended him to enclose a piece of camphor in the bags of seed peas with a view of destroying the insect; this he had tried, and found useless. Mr. Gott, of Arkona, had not found the beetles so plentiful this year as usual. The subject was discussed at some length, and the general opinion expressed that the most feasible remedy was to cease growing peas for a time in any district where the insect had proved seriously destructive, and thus starve them out.

THE MAPLE TREE BORER.

Prof. Bell remarked that he had found this borer, *Clytus speciosus*, not nearly so common as formerly. Mr. Saunders said that he believed it to be increasing in the neighbourhood of London, and that some of the street trees had been seriously injured by it; he also referred to the depredations of another maple borer, *Aegeria acerni*, a small moth whose larva burrows under the bark of the Red Maple, *Acer rubrum*, and in season was quite common on the trunks of the maple trees on our streets. Mr. Reed also reported the maples round his house being much infested by this pest, the empty cocoons being found protruding from the trunks of the trees in quantities during the summer.

A discussion then ensued on the probabilities of new insect pests being introduced from abroad by the importation of grains, seeds and trees, in which several of the members took part. Mr. Weld urged that the Society should call the attention of the Government to the necessity of taking every possible precaution to prevent the introduction of such insects. The President remarked that in his official capacity he had, through the Provincial Agricultural Association, already brought this matter before the Government, and that some steps in this direction had been taken.

The meeting then assumed an informal character, and the members were shown by Messrs. Saunders, Denton, and Reed many of the more interesting specimens in the Society's large collections, and also exhibited microscopic specimens illustrating the structure of insects. The valuable library of the Society was also examined by the members, and added to the interest of the gathering.

After enjoying a very pleasant and profitable evening, the meeting adjourned.

MEETING OF THE SUB-SECTION OF ENTOMOLOGY OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The meeting of the American Association for the Advancement of Science was held at Cincinnati, Ohio, commencing at 10 o'clock a.m. on Wednesday, the 17th of August, 1881. At the conclusion of the opening exercises the several Sections proceeded to organize, when the Sub-section of Entomology was called to order by the President, Rev. J. G. Morris. A large number of Entomologists were present, among others C. V. Riley, Washington; Cyrus Thomas, Carbondale, Ill.; Wm. H. Edwards, Coalburgh, W. Va.; J. A. Lintner, Albany, N. Y.; Rev. J. G. Morris, Baltimore, Md.; Wm. Saunders, London, Ontario; E. W. Claypole, Yellow Springs, Ohio; Miss M. W. Brooks, Salem, Mass.; B. Pickman Mann, Washington; C. D. Zimmermann, Buffalo, N.Y.; A. J. Cook, Lansing, Mich.; J. D. Putnam, Davenport, Iowa; S. H. Peabody, Champaign, Ill.; V. T. Chambers, Covington, Ky.; and Chas. Drury, Avondale, Ohio.

On Thursday, August 18th, the Sub-section of Entomology met at 2.30 p.m.

The first paper read was by Prof. C. V. Riley, on Retarded Development in Insects. In this paper the author recorded several interesting cases of retarded development in insects, whether as summer coma, or dormancy of certain portions of a given brood of caterpillars, the belated issuing of certain imagines from the pupa, or the deferred hatching of eggs. One of the most remarkable cases of this last to which he called attention was the hatching this year of the eggs of the Rocky Mountain Locust or Western Grasshopper, *Caloptenus spretus*, that were laid in 1876 around the Agricultural College at Manhattan, Kansas. These eggs were buried some ten inches below the surface in the fall of 1876 in grading the ground around the chemical laboratory, the superincumbent material being clay, old mortar and bits of stone, and a plank sidewalk above this.

In removing and regrading the soil last spring, Mr. J. D. Graham noticed that the eggs looked sound and fresh, and that they readily hatched when exposed to normal influences; the species being determined by Prof. Riley from specimens submitted by Mr. Graham. Remarkable as the facts are, there can be no question as to their accuracy, so that the eggs actually remained unhatched during nearly four years and a half, or four years longer than is their wont. This suggests the significant question: how much longer the eggs of this species could, under favoring conditions of dryness and reduced temperature, retain their vitality and power of hatching?

Putting all the facts together, Prof. Riley concludes that we are yet unable to offer any satisfactory explanation of the causes which induce exceptional retardation in development among insects. The eggs of Crustaceans, as those of *Sepus* and *Cypris*, are known to have the power of resisting drouth for six, ten or more years without losing vitality, while in some cases they seem actually to require a certain amount of desiccation before they will hatch. Yet the fact remains that different species act differently in this respect, and that individuals of the same species, under like external conditions of existence, act differently; that temperature, moisture, food, etc., do not influence them alike. We can understand how this great latitude in susceptibility to like conditions may, and does in the case of exceptional seasons, prove beneficial to the species by preserving the exceptional individuals that display the power to resist the usual changes.

The next paper was by the same author, on New Insects injurious to American Agriculture, in which attention was called to several insects hitherto unknown as injurious, which during the present year have proved very destructive to one crop or another. Such hitherto unknown and unreported injury is either caused by—1st, imported species; 2nd, native species previously known, but without destructive habit; 3rd, unknown or undescribed species.

Mr. W. H. Edwards then read a paper on certain habits of *Heliconia charitonia*.

Some interesting discussion followed the reading of these papers, after which an informal discussion on Entomological subjects took place, in which many of the members joined. The meeting then adjourned.

On Friday, at 11.30 a.m., the Entomological Sub-section held another session.

The first paper, "On the Length of Life of Butterflies," was read by W. H. Edwards, followed by one on the Life Duration of the Heterocera, by J. A. Lintner, both of which will appear in the pages of the *Entomologist*.

A few remarks were made by C. V. Riley on his own extended observations on the duration of the lives of both butterflies and moths, indicating that they were, as a rule, of very short duration.

Cyrus Thomas stated that according to his observation the Army Worm, as a caterpillar, a chrysalis and a moth, existed in all seventy-seven days. Some observers had, however, made it seventy-six, others seventy-nine days. He contended that in confinement, in a proper temperature and with ample food, the Army Worm passed through its metamorphosis more quickly than in natural conditions.

B. P. Mann disagreed with Mr. Thomas on this latter; so also did C. V. Riley, it being contrary to their experience.

J. A. Lintner, State Entomologist of New York, then read a paper on "A Remarkable Invasion of Northern New York by a Pyralid Insect."

He said that about the middle of May, of the present year, a serious invasion of St. Lawrence County, N. Y., and several of the adjoining counties, by the "Army Worm" was announced. It was stated that many pastures had been completely ruined, and the entire destruction of the pastures and meadows was threatened. Not having witnessed the operations of the Army Worm, he at once visited the infested locality. The reports had not been exaggerated. The injury was widespread and serious, already extending over eight of the northern counties. Hundreds of acres of grass presented a brown appearance, as if they had been winter-killed. A pasture lot of fifty acres, which ten days before offered good pasture, was burned so that in places not a blade of grass could be seen to the square yard. Numerous dead caterpillars were adhering to the dead stems of last year's grass, which it was believed had fallen victims to starvation. The upland pastures were first attacked. The progress was remarkably rapid; entire fields were laid waste in ten or twelve days. The secrecy of the depredations was remarkable. The larvæ had seldom been seen, and never observed in active feeding. It was believed by the farmers that they fed at night, or by drawing the blades of grass into their subterranean retreats. In two instances the larvæ were observed in immense numbers, collected on the trunks of trees, so that they could have been scooped up by handfuls.

The tree trunks were enveloped by a firm web of silk, spun by the caterpillars, of so firm a consistence that it could be lifted up in a sheet like a piece of woven silk. The cause of the congregation at this point could only be conjectured. It was not for feeding on the foliage, for the grasses alone were eaten by the caterpillars.

The caterpillars observed and collected by Mr. Lintner were slender, cylindrical forms, sixteen footed, of an obscure greenish colour, with a shining black head. They were destitute of lines or other ornamentation, except some warty spots on their upper side. Their average length was three-fourths of an inch. He was unable to identify them with the Army Worm, for they were quite unlike the mature form of that species, and their habits seemed to be quite different.

On the 6th of August the first moth emerged from some cocoons furnished by Mr. J. Q. Adams, of Watertown, N. Y., and it turned out to be a *Crambus vulgivagellus*.

The interesting question as to which of our insect depredators was chargeable with the ravages in Northern New York was decided. The new enemy was found to be an inconspicuous, hitherto unobtrusive little *Crambus*. It had long been known in our cabinets, but had never before presented itself as an injurious insect.

It is probable that several accounts of injuries to pasture lands in New England States during the last three or four years, which have been ascribed either to the Army Worm or an unknown depredator, are due to this species. Its subsequent appearance may hereafter be recognized.

The Crambidæ are small moths with narrow front wings often marked with metallic spots and stripes, which are frequently driven up for short flights in our pastures and meadows during the fall months. Specimens of the larvæ, pupæ, cocoons and perfect insects were exhibited to the Section.

Following this three papers were read by A. J. Cook, of Lansing, Mich., "How Does the Bee Extend its Tongue?" "The Syrian Bees," "Carbolic Acid as a Preventive of Insect Ravages."

The author explained how the bee extends its tongue by means of a diagram; it is done, he believes, by forcing into the extremity of that member some of the fluid contained in the glands. In his paper on Syrian Bees, he related how D. A. Jones, of Canada, and Frank Benton, of Michigan, went to Europe in search of new varieties of bees. They brought from Cyprus both the Cyprian bee and the Syrian bee, and Mr. Benton went to Ceylon and Java in search of other varieties. From the former place he brought two new species not very unlike our own, but in Java he failed to find the great Java bee. With the Syrian bees the author had Syrianized the apiaries of the Michigan Agricultural College. The Syrians are of a yellow type, closely allied to the Italian bee; they are indefatigable workers, but more irritable than other bees, especially when queenless. They are undoubtedly a valuable acquisition to American apiculture.

The next paper was by Mr. W. H. Edwards, on "The Alleged Abnormal Peculiarity in the History of *Argynnis myrina*," which was followed by one by E. W. Claypole, of Yellow Springs, Ohio, on the Buckeye Stem Borer. The writer remarked that during the spring months some of the leaves of the Buckeye tree droop and die without any obvious cause; indeed these dying leaves may be seen almost as soon as the foliage is expanded. On examination, a small hole was discovered in every stalk on which a dying leaf was found, and in splitting this round stalk a living caterpillar was observed ensconced in the narrow tunnel evidently excavated by itself. The destruction of the central part of the leaf stalk was clearly the cause of the death of the leaf. A number of leaves were collected and the larva reared in confinement, producing a small moth closely resembling *Sericoris instrutana.* When or where the egg is laid has not been discovered. The young larvæ may be found in the leaf stalks of the Buckeye tree from the 2nd to about the 8th of May. After spending a few days in this secure retreat, it comes out and dwells for the rest of its caterpillar life in the dying leaf at the top of the stem upon which it feeds; after thus feeding for about a fortnight it passes into the chrysalis state, from which in about ten days more it emerges a moth.

The President then read his annual address.

PRESIDENT'S ADDRESS.

GENTLEMEN,—I regret exceedingly that I am compelled to begin my address by the recital of a melancholy event in the history of our Section.

About ten days after our adjournment last year, and after probably we had all arrived at home and settled down to our autumn's work, the distressing intelligence reached us of the sudden death of one of our most honoured and distinguished members. He had mingled with us at Boston and had taken part in our deliberations, and though cheerful and full of hope, yet his usually buoyant temperament was plainly mellowed by advancing years, the every-day anxieties of life, and the pressure of severe intellectual pursuits. He returned home after our adjournment and immediately resumed his linguistic studies with his usual incessant ardour, for he often said to me: "I never take exercise when I am at home, but work all day and sometimes late into the night," and on the 1st of September, 1880, Samuel Stehman Haldeman was suddenly stricken down. His lamented death has been noticed in most of the leading papers and scientific journals of the country, accompanied with some biographical facts, for he was widely known as a scholar and a scientist, and no man was more highly esteemed as a companion and gentleman. We all are aware of the distinction he achieved in letters and science in our own and foreign countries, of the learned books and papers he has written, and of the titles and prizes which his works secured for him.

If this were the proper place, it would be pleasing to dwell, even at length, upon the many valuable traits of his character, the vast extent of his diversified acquirements, and his almost unparalleled qualities as a friend and scientific fellow-labourer. I feel as if I were announcing the death and reciting the admirable virtues of a brother. For forty years he and I were what may properly be called "bosom friends." In early life we were engaged in similar scientific pursuits, and living but a few hours' distance from each other, our mutual visits were frequent, and our warmest friendship and confiding intercourse continued uninterrupted to the end.

It is well known that in early life he devoted much of his time to our favourite science, to which he made some valuable contributions. His principal papers are: Materials toward a History of Coleopterous Longicornia of the U. S.; Corrections and Additions to this paper; Description of N. Am. Coleoptera; Cryptocephalinorum Borel. Am. Diagnosis. These papers give evidence of honest and painstaking research, patient analysis and sharp discrimination, and are profitably consulted by investigators of the present day.

Of late years he had turned his attention particularly to the study of language, and became a distinguished member of the Philological Society. All readers know the celebrity he attained in that department, and the ardour with which he pursued those studies; but notwithstanding their engrossing attractions, he never ceased to feel an interest in everything that concerned our department. It is hard for a man to forget his first love.

Thus much I thought it proper to say of the lamented Haldeman. He was no ordinary man, whom you might compliment with a passing respectful obituary notice. In science and letters he was a great man. His memory will be long cherished by admiring friends. "*Idem extinctus amabitur.*" It may not be out of place to mention here one fact to me, at least, personally interesting. Less than two months ago the monument of Haldeman, chiselled out of enduring granite by Strecker, a brother Entomologist, was erected over his grave by the pious care of the skilful artist himself, who spends his days in cutting marble and granite into classic forms, and half of his nights in studying and figuring the butterflies of his own unequalled private collection.

Gentlemen, forty years ago I could count the known working Entomologists of our country with the first ten numerals. The older Melsheimer, who may properly be designated as the father of our science in this country, Say, Peck, Gould, Randall, Peale, and a few other pioneers, had died or retired, and the only workers then were Harris, of Cambridge; Major LeConte and his son John L., of the city of New York; Fitch, of the State of N. Y.; Haldeman, Melsheimer, jr., and Zeigler, of Pennsylvania, and a few others of no special note, were the only ones, as far as is at present recollected, who prosecuted our science with any zeal, and who contributed to its progress by the descriptions of species. There were others who collected insects, but they made no claim to be scientific Entomologists. I remember distinctly when Melsheimer, Haldeman, Zeigler and I used to meet several times a year at our respective homes to read papers, discuss questions, exhibit new species, recite our Entomological adventures, and then adjourn to a well-appointed table. We regretted that we had no collaborators within two hundred miles, for the LeContes, in New York, were our nearest neighbours. In that day there was not a man in Philadelphia who studied insects. We then established "The Entomological Society of Pennsylvania," and after electing all our confreres in this country as honorary members, we had the audacity to confer the same distinction upon some great men abroad, whose letters of grateful acceptance indicated that they thought that the Society was something more than a club of four comparatively unknown men meeting in Haldeman's study on the banks of the Susquehannah!

And now look at the mighty change. In the Naturalist's Directory for 1880 there are no less than 436 names reported as pursuing our science. Now, whilst it is true that many of these may be collectors only, still they are more or less useful. They all must be interested in it to a greater or less extent, or they would not have reported themselves as such. Be this as it may, the increase is simply wonderful and very encouraging. Doubtless there are numerous others in the country engaged in the same delightful employment whose names do not appear in the Directory.

There is no other distinct branch of science that has so many representatives in that book as ours, excepting Botany and Geology, and in Zoology specially we are ahead of the Ornithologist by over 50; the Conchologist are fewer than 100 all told, and all other specialists in Zoology are behind us. All this is cheering, and we are sure that the number of collaborators is growing every year.

But there is a still more encouraging view of the subject, which is founded not only on names, but on facts, and I am sure it will gratify the Section to hear of the number of the published contributions of our fellow-workmen. True, they are not all members of this Section, but they belong to the family, and we hail them as brethren of the same household.

Most of us have, of course, kept our eyes upon the various journals, and have been pleased to see so many papers, and yet perhaps few of us have any proximate conception of their number and variety. Hence I have thought that probably the most acceptable contribution I could make at this meeting would be a complete list, as far as was possible, of all American Entomological writers since our meeting in August last, and this I have done and will present it at the proper time. Some names may have been inadvertently omitted, but these can be subsequently introduced. In order to insure perfect accuracy and fullness, I made the list of each author's writings as far as I could find them and sent it to him for correction, and I here desire to thank those gentlemen for the uniform courtesy with which they granted me their aid.

This paper will give us a better idea of the progress of our science during the past year than any other mere description possibly could.

A brief analysis of it gives 77 writers and 302 titles; 25 of these articles treat of Coleoptera; 19 of Lepidoptera; 15 of Orthoptera; 5 of Neuroptera; 10 of Diptera; 11 of Hymenoptera; 11 on Hemiptera; 8 or 10 describe larvæ of various orders; 5 or 6 are on fossil insects; a few on Myriopods and Spiders, and 11 on Economic Entomology.

This brief exhibit will give an idea of what has been done as far as has been made public. Doubtless there are many other papers in preparation, and much efficient work has been privately done which may never be published.

It would be out of my province to specify any of these writings in this address, and much more to express any opinion of their relative value, or to indulge in any critical remarks. That must be left to the reviewers.

We now have four journals exclusively devoted to our science, and in several others considerable space is allotted to it. In connection with these must be mentioned the annual reports of the State Entomologists. The Proceedings and Transactions of all Natural History Societies also contain frequent articles upon the subject.

The Canadian Entomologist, *Psyche*, *The Bulletin* of the Brooklyn Entomological Society, and *Papilio*, should be supported by every one of us. Indeed, no man can know how our cause is advancing without them, and as it is likely that none but Entomologists read them, so much the more general should be our patronage that they may be maintained.

Each of these four seems to occupy its peculiar field. *The Canadian* is general, and the organ of a special association. Although it is geographically *extra limital*, yet it is very near to us, and a large share of its original papers come from this side of the Niagara. We claim it as one of our own, and being the oldest and admirably conducted, we hope that its present efficient editor may long continue to conduct it and render it still more interesting and instructive.

The next oldest is *Psyche*, and in relation to it I may quote what our first President said in his opening address: "*Psyche*, though small, is indispensable to every one occupied with the insects of North America." It covers a ground not occupied by any other periodical in the world, and is very creditable to the disinterested labours of American Entomologists. Its accuracy has never been questioned, and it is extremely desirable to secure its continuous publication. You know that it was begun by the Cambridge Entomological Club, which is really the parent of the Club of the A. A. A. S., which has now been elevated to the dignity of a Sub-Section. The Cambridge Club differs from some others in the country in freely granting the use of its library to Entomologists throughout the whole country, and hence it is very desirable that the library should be enriched and the Club thus enabled to extend its benefits still more widely.

The Bulletin of the Brooklyn Entomological Society is a spirited publication, displaying much zeal, correct diagnosis and careful description.

Papilio, the youngest of the family, is entirely devoted to Lepidoptera, and thus occupies an exclusive field and cultivates it successfully. The necessity for it arose, I apprehend, from the fact that our investigators had so much that was new to publish, that room could not be found in the other journals; and when we consider that the number of our writers is increasing every year, and new discoveries are constantly made, it is plain that all the journals now in existence among us could not publish all the communications unless the journals were greatly enlarged. As it is likely that all these editors render their valuable services gratuitously, and that the present patronage would not justify an enlargement, we shall have to be content for some time to come with their present size.

It is much to be regretted that it was deemed necessary by the editor of the *American Entomologist* to suspend its publication in January last. We have all derived instruction from its pages, but whilst we shall not hereafter have its monthly greetings as a distinct journal, there is some compensation in the fact that the department it so ably represented has been transferred to the *American Naturalist*, in which we discern evidences of the same talent which distinguished it under its previous form.

In conclusion, I will make bold to throw out one or two suggestions.

1. In view of the wonderful progress which our science has made in this country, has not the time come for condensed, complete, systematic books on each of the Orders, after the style of many German books that might be mentioned? Every one of us is often asked by beginners: What book would you recommend on beetles? And our answer is: There is none which contains descriptions of all our known species in systematic order, but you must gather them from various monographs, journals and proceedings, which are not easy to procure. This disheartens the young student. The same is to a great extent

also true of butterflies, especially of *Noctuidæ* and of other orders of insects, although the want is supplied in *Lepidoptera* more fully than in any other. But even this order, beyond the Diurnals, although hundreds of species are described, has not been brought together in systematic arrangement. The material is at hand, and nothing is wanting but a competent editor and an accommodating publisher to bring out a series of works which would contribute immeasurably to our progress.

My second suggestion is, that it would be interesting to know the extent, character and condition of the larger public and private collections in the country, with a mention of the varieties they contain. This might embrace two sections, those of our own species and those of foreign countries. A paper on this subject for the next meeting would be an interesting contribution, and I hope some gentleman will furnish it; or let some member be appointed, so that there may be no conflict, and the whole field be open to him. No doubt the owners of private collections and the curators of public ones would cheerfully render him their counsel and aid.

And now, gentlemen, congratulating you upon our meeting again, let us proceed to our business and prosecute it with vigour, patience and order.

JOHN G. MORRIS.

At the conclusion of the address a vote of thanks was tendered to the President, coupled with the request that the copy be sent to the *Canadian Entomologist* for publication, which was kindly assented to.

On Saturday morning the Entomological Sub-section was again in session, when the following papers were read:

The Egg Case of *Hydrophilus triangularis*, by C. V. Riley; on the Oviposition of *Prodoxus decipiens*, and also one on the Cocoon of *Gyrinus* by the same author. Following these a paper was presented by B. P. Mann, entitled Suggestions of Co-operation in Furthering the Study of Entomology; and another by C. V. Riley, on New Insects Injurious to American Agriculture.

In this latter paper the author called attention to several insects hitherto unknown as injurious, which during the present year have proved very destructive to one crop or another. Such hitherto unknown and unreported injury is either caused by, 1st, imported species; 2nd, native species previously known but without destructive habit; 3rd, unknown or undescribed species. The author gave an account of the injury which had been done to clover plants by a beetle, *Phytonomus punctatus*, in Yates Co., New York. The cocoons of the beetle were found on the ground in the fields, but the beetles were difficult to find on account of their shyness, as they fall to the ground when approached. Mr. Riley also reported that much injury had been done to corn in South Carolina and Georgia by a borer which was probably the larva of a Pyralid moth.

After the reading of papers an informal discussion on Entomological subjects took place.

Mr. A. J. Cook remarked that *Heliothis armigera* had attacked corn in Michigan for the first time in 1880. That was a very wet year, whereas this year had been very dry, and this season the army worm, *Leucania unipuncta*, had been observed injuring it for the first time.

Mr. W. Saunders said that the imagos of the army worm, *Leucania unipuncta*, had been unusually abundant in Ontario during the summer, and had been seen at sugar in great numbers, and referred to the fact that the destructive brood of this insect was not the first brood. Mr. Cook had found the moths similarly abundant in Michigan.

Mr. Cyrus Thomas stated that he had positive proof that the eggs of *Leucania unipuncta* had been deposited in fields of oats. He also said that wet weather was very favourable for the development of this insect.

Mr. J. A. Lintner spoke of the great abundance of the clover-seed midge, *Cecidomyia leguminicola*, which was rapidly spreading over a large area. Mr. B. P. Mann considered that the rearing of insects in the house tended to prolong the life of the larvæ, and to shorten that of the pupæ. Mr. C. V. Riley agreed with him, but Mr. Thomas held the opposite view.

Mr. S. H. Peabody, speaking of the duration of life of some moths, remarked that in *Endropia* and in *Ctenucha virginica* the period of existence of the imago was short.

Mr. Riley said that *Anisota rubicunda* feeds on both the hard and soft maple trees, and that the colouring of the imago in the western limits of the region where the moth is found is very pale in colour. Mr. J. A. Lintner stated that he had captured this insect at Schoharie, N. Y., having a yellow colour with only a slight tinge of rose.

Mr. W. H. Edwards remarked that he had found *Thecla henrici* only in April. It feeds on the wild plum tree. The larva eats into the unripe plums, burying its head and shoulders in the fruit, and eats no other kind of food. The larva becomes full grown by the time that the plum has become half grown. The insect has but one brood in the year. Mr. Edwards also remarked that *Lycaena violacea* feeds upon many different food plants.

The meetings of the Entomological Sub-section were throughout very interesting and profitable, and the "brethren of the net" separated with regret, the hope being expressed by all that they might be privileged to meet again next year in Montreal.

POPULAR PAPERS ON ENTOMOLOGY.

ENTOMOLOGY FOR BEGINNERS.

THE SATELLITE SPHINX—*Philampelus satellitia* (Linn.).

BY WM. SAUNDERS, LONDON, ONT.

This is one of the most beautiful of our Sphinx moths, a rare as well as lovely creature, and an object highly prized by collectors. It is found throughout the northern United States and occasionally in Canada, but is nowhere very common.

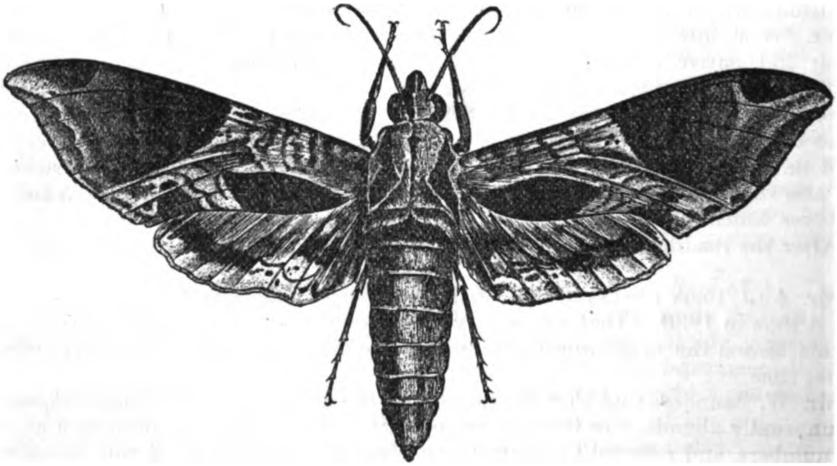

Fig. 1.

The moth (fig. 1), when its wings are expanded, will measure from four to four and a half inches across. Its colour is of a light olive mixed with gray and varied with patches of a darker olive-green, rich and velvety, and some portions with a rosy hue. The moths appear in July, when, after pairing, the female deposits her eggs singly on the leaves of the grape-vine or Virginia creeper *(Ampelopsis quinquefolia)*, where they shortly hatch into small green larvæ of a pinkish hue along the back and with a very long pink horn at the tail. As the caterpillar increases in size the tail becomes shorter, and after a while curves round, as shown at *c* in fig. 2. As the larva approaches maturity it changes to a reddish-brown colour, and after the third moult entirely loses the caudal horn, which is replaced by a glassy eye-like spot. The mature larva when in motion, as shown at *a*, fig. 2, will measure nearly four inches in length, but when at rest it draws the head and two adjoining segments within the fourth, as shown in the figure at *b*, which shortens its length nearly an inch, giving it a very odd appearance with its anterior portions so blunt and thick. It is of a rich reddish brown colour, of a lighter shade along the back, with five or six nearly oval cream-coloured spots along each side from the fifth to the tenth segments inclusive; sometimes the spot on the fifth segment is indicated by a dot only, in other instances entirely wanting. On the anterior segments there are a number of black dots; a dark polished raised eye-like spot in place of the tail; stigmata black, showing prominently in the cream-coloured spots along the sides.

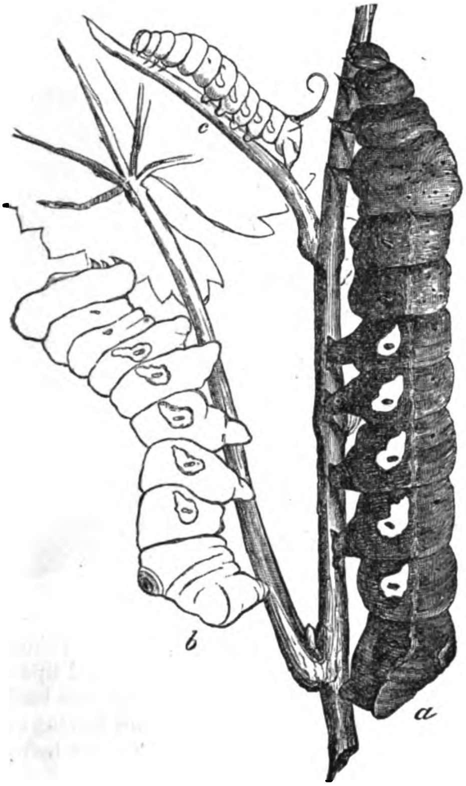

Fig. 2.

It is a very voracious feeder, and where present strips the vine so rapidly of its leaves that it soon attracts attention. When full grown it descends and buries itself in the ground, where it forms an oval cell, within which it changes to a chrysalis.

The chrysalis is of a chestnut brown colour, with the segments roughened with impressed points, the terminal ring having a long thick spine. The insect usually remains in the chrysalis state until the following summer, but sometimes it hatches the same season. In the 9th vol. of the *Canadian Entomologist.* p. 120, an instance of this sort is recorded by Mr. R. Bunker, of Rochester, where the larva became a chrysalis on the 1st of August, and produced the moth on the 10th of September. Should these larvæ at any time prove troublesome, they can be readily subdued by hand-picking.

THE INDIAN CETONIA *(Euryomia inda).*

This is a stout, hairy beetle (fig. 3), which makes its appearance early in spring, usually towards the end of April or beginning of May, flying about in open fields and about the borders of woods, with a loud buzzing sound resembling that of a bumble bee. It belongs to the flower beetles, most of whom live on pollen and the honey of flowers, and are fond of sweets.

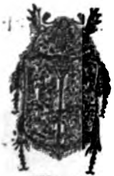

Fig. 3.

This insect is of a brownish-gray color, dotted and spotted with blackish and thickly covered with short greenish-yellow hairs. It measures half an inch or more in length. During the summer it disappears, but a second brood comes out in the fall, usually during September, when they may be found feeding on the pollen of flowers and also upon the sweet sap of plants and trees. Not content with this, they attack our finest and most luscious fruits, eating their way into the richest ripening pears and burrowing into the finest peaches so deeply that only the tips of their bodies are visible, and in this way spoiling the fruit and inducing rapid decay. They also attack grapes and other sweet fruits.

THE LEGGED MAPLE BORER—*Aegeria acerni* (Clemens).

In 1860 Dr. Clemens described this pretty moth in the Proceedings of the Academy of Natural Sciences, Philadelphia, and since then it has been written on by Mr. P. Gennadius in the *American Naturalist* for January, 1874, and in the same year by C. V. Riley, in his 6th Missouri Report. It is well figured in the accompanying cut, figure 4 (after Riley), in all its stages; *a* shows the larva, *b* the cocoons exposed by removal of the bark, *c* the moth, and *d* the chrysalis.

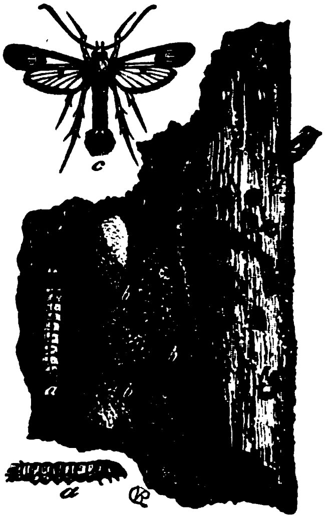

Fig. 4.

The moth appears late in May and during June. When the wings are expanded it measures about three-quarters of an inch across; its wings are transparent, decorated with bluish-black markings. The head and palpi are of a deep reddish-orange, antennæ bluish-black, thorax ochreous yellow, abdomen bluish-black varied with ochreous yellow and terminated by a tuft of brilliant reddish-orange hairs.

The under side of the body is ochreous-yellow, with bluish-black markings.

The female deposits her eggs on the bark of the soft and sugar maple trees, chiefly on the former, and when hatched the young larvæ burrow through the bark and feed upon the inner portion and sap wood, never penetrating to the solid heart wood. The excavations made by the larva are filled with its brown castings. When full grown it is more than half an inch long, cylindrical to the eleventh segment, then tapering to the end, with the skin wrinkled and folded. The head is small, of a yellow colour, cervical shield paler; stigmata brown; legs and tips of prolegs reddish. When the larva is full grown it eats its way nearly through the bark, leaving but a very thin layer unbroken; it then retires within its burrow, and having enclosed itself within a loose, silky cocoon, changes to a brown chrysalis. A short time before the moth escapes the chrysalis wriggles itself forward, and pushing itself against the thin papery-like layer of bark, ruptures it and the chrysalis protrudes as shown in the figure. Soon afterwards the imprisoned moth in its struggles ruptures the chrysalis and escapes.

This insect appears to be increasing in numbers every year, and is very destructive, especially to young maple trees. Many of our shade trees in London are much injured by it, and where very numerous it is liable to completely girdle the tree and kill it. It is also found throughout the Middle States. To prevent the moths from laying their eggs, the trunks of the trees should be painted about the 1st of June with a mixture of soft soap and lye about the thickness of paint, or with a mixture of lime and soap. When once the larvæ obtain an entrance it is very difficult to discover them, and they will then carry on their destructive work all through the summer.

THE RED-HUMPED APPLE TREE CATERPILLAR (*Notodonta concinna*).

This insect appears in the perfect or moth state (fig. 5) during the latter part of June. When its wings are expanded it measures from one inch to one inch and a quarter across. The fore wings are dark brown on the inner margin and grayish on the outer margin, with a dot near the middle, a spot near each angle and several longitudinal streaks along the hind margin dark brown. The hind wings of the male are brownish or dirty white, those of the female dusky brown; the body is light brown, the thorax of a darker shade.

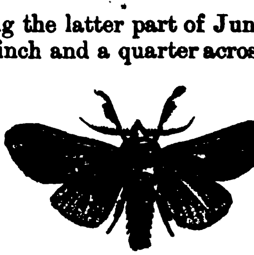
Fig. 5.

The female deposits her eggs in a cluster on the under side of a leaf during the month of July, where they shortly hatch into tiny caterpillars, which at first consume only the substance of the under side of the leaf, leaving the upper surface unbroken, but as they increase in size they devour the entire leaf. When not eating they lie closely together on the twigs, and sometimes entirely cover the branches they rest on; they attain their full growth during August or early in September. When mature the larva presents the appearance shown in fig. 6. The head is coral red, and there is a lump on the back on the fourth segment of the same color. The body is traced lengthwise by lines of black, yellow and white, and has two rows of black spines along the back, and other shorter ones upon the sides, from each of which there arises a fine hair. The hinder segments taper a little and are always elevated, as shown in the figure, when the insect is not crawling. It measures when full grown about one and a quarter inches long.

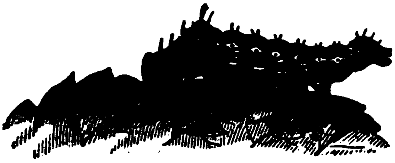
Fig. 6.

They entirely consume the leaves of the branch on which they are placed, and when these furnish insufficient food to bring them to maturity, the adjoining branches are laid under tribute. When handled they discharge from their bodies a transparent fluid with a strong acid smell, which doubtless serves as a defence from their enemies, especially birds, since their habit of feeding openly in large flocks renders them particularly liable to attack from these active foes.

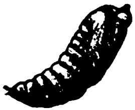
Fig. 7.

When full grown they all disappear about the same time, descending from the trees to the ground, where they conceal themselves under leaves upon or slightly under the earth. Here, after a long time, the larva changes to a brown chrysalis, fig. 7, and remains in this condition until late in June or early in July of the following season. They are very generally distributed, but seldom abundant, and while very partial to the leaves of the apple tree, feed also on those of the plum, pear, cherry, rose, and thorn.

As they feed in flocks during their entire existence, these larvæ can easily be gathered and destroyed, either by cutting off the limbs on which they are feeding and burning them, or by dislodging them by suddenly jarring the limbs, when the larvæ fall to the ground and may be trampled under foot.

THE EYED ELATER *(Alaus oculatus)*.

This is the largest of our Elaters or "spring beetles," and is found with its larva in the decaying wood of old apple and other trees. The beetle, fig. 8, is about an inch and a half—sometimes more—in length, of a black colour, sprinkled with numerous whitish dots. On the thorax there are two large velvety black eye-like spots, from which has arisen the common name of the insect. The thorax is about one-third the length of the body, and is powdered with whitish; the wing cases are ridged with longitudinal lines, and the under side of the body and legs thickly powdered with white. It is found in the perfect state in June and July; is active in the daytime, flying about with a loud buzzing noise.

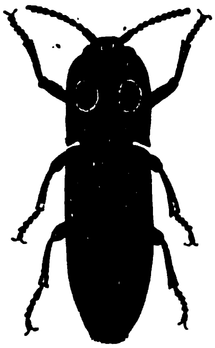
Fig. 8.

The mature larva, which attains its full growth early in April, is about two and a half inches long, nearly four-tenths of an inch across about the middle, tapering slightly towards each extremity. The head is broad, brownish, and rough above; the jaws very strong, curved and pointed; the terminal segment of the body blackish, roughened with small pointed tubercles, with a deep semicircular notch at the end, armed at the sides with small teeth, the two hindermost of which are long, forked, and curved upwards like hooks. Under this hinder segment is a large, fleshy foot, armed behind with little claws, and around the sides with short spines; it has six true legs, a pair under each of the first three segments. Early in spring the larva casts its skin and becomes a chrysalis, and in due time emerges a perfect beetle.

This beetle, when placed upon its back on a flat surface, has the power of springing suddenly into the air, and, while moving, turning its body, thus recovering its natural position; this unusual movement, together with its curious, prominent eye-like spots, combine to make it a constant source of wonder and interest. Since it feeds only on decaying wood, it scarcely deserves to be classed with destructive insects.

THE STAG BEETLE *(Lucanus dama).*

This is another very common beetle, somewhat similar in its habits to the eyed Elater, but very different in appearance. It is a large and powerful insect belonging to the family called *Lamellicornes*, or leaf-horned beetles, from the leaf-like joints composing their antennæ. In the male, fig. 9, the upper jaws or mandibles are largely developed, curved like a sickle, and furnished internally beyond the middle with a small tooth; those of the female are much shorter and also toothed. The body measures from an inch to an inch and a quarter in length, exclusive of the jaws, and is of a dull mahogany-brown colour. The head of the male is broad and smooth; that of the female narrow and roughened with punctures. The insect appears during the months of July and August; is very vigorous on the wing, flying with a loud buzzing sound during the evening, when it frequently enters houses to the alarm of nervous occupants. It is perhaps scarcely necessary to remark that it is not in any way venomous, and it never attempts to bite without provocation.

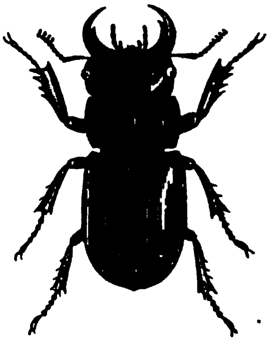

Fig. 9.

The female lays her eggs in the crevices of the bark of trees, especially near the roots. The larvæ live in decaying wood, and are found in the trunks and roots of various kinds of trees, particularly those of old apple trees; they are also found in old cherry trees, willows, and oaks. They are said to be six years in completing their growth, living all the time on the wood of the tree, reducing it to a coarse powder resembling sawdust. The mature larva is a large, thick, nearly cylindrical whitish worm, with a horny-looking head of a reddish-brown colour, dark mandibles, and reddish legs. The body is curved when at rest, the hinder segments being brought towards the head.

When the larva has attained full size it remains in its burrow and encloses itself in an oval cocoon formed of fragments of wood and bark, cemented together with a glue-like secretion, and within this enclosure it is transformed to a chrysalis of a yellowish-white colour. Through the partially transparent membrane the limbs of the future beetle are dimly seen, and in due time the beetle bursts its filmy enclosure and emerges to the light of day.

As this insect affects only old and decaying trees, it seldom does much harm. The use of alkaline washes, applied to the bark of the trees in July, would probably deter these beetles, in common with others, from depositing their eggs on the trees thus coated, and any mischief they might otherwise do be in this manner prevented.

SOME FUNGI-EATERS.

BY W. HAGUE HARRINGTON, OTTAWA, ONT.

It is related by a celebrated traveller and naturalist that, in the dreary islands of Terra del Fuego, the only vegetable food to be obtained by the wretched inhabitants, with the exception of a few berries, is a fungus which grows in great abundance on certain trees. This fungus appears on the bark in the shape of bright yellow, globular masses of the size of small apples, and at a certain stage of development is gathered and eaten uncooked. Other savage tribes inhabiting barren territories may be partially dependent on similar substitutes for the nutritious roots and succulent fruits used by more favourably located races; but civilized man, with his long list of food plants to choose from, considers fungi more as luxuries than as essential articles of diet.

The common field Mushroom *(Agaricus campestris)*, found wild throughout the greater part of the world, ranks high as a table delicacy, and is largely cultivated in some countries. Several other species of fungi are also used in considerable quantities; for instance, the famous Truffle, which grows several inches below the surface of the ground, and requires to be hunted with the aid of dogs trained to scent them out. Many others, likewise very wholesome and palatable, are, however, seldom used because of their resemblance to poisonous varieties.

We find man not alone in his liking for fungi and his use of them as food. Domestic cattle and many wild animals also relish them and devour species shunned by man. The insect world produces a great variety of species subsisting either in the larval or perfect state, or in both, upon fungus. Often when a fine, fresh-looking, pink-gilled, snowy-clad Mushroom is plucked, the picker finds, much to his disappointment and disgust, that his savoury morsel is already "food for worms." A number of small grubs are feasting within the stalk, and in a few hours the cherished Mushroom becomes a black decaying mass, filled with little maggots.

A great variety of fungi are similarly attacked and made the banqueting chambers of numerous foes. The tender, short-lived species, such as Mushrooms and Toadstools, decay and perish quickly; but the harder kinds, growing upon old and dead or fallen trees, harbour their tenants much longer, and preserve their shape and outward comeliness even after they have been eaten and withered away inwardly.

The object of this brief paper is to call the attention of any who have recently commenced collecting to the fact that fungi are so much frequented by insects, and that many species can be obtained from them with but little trouble. I will therefore briefly mention a few of the numerous *Coleoptera* which I have taken on or in fungus, not because they are rare beetles, but rather because they may be easily obtained and are well known.

Megalodacne heros is the finest beetle which I have found feeding upon fungus. It belongs to the *Erotylidæ*, a family known by the large antennal club, formed by an enlargement and flattening of the three last joints. This family is said to be largely developed in tropical America, where its members are mostly leaf-eating beetles, differing in this respect from northern species, which live upon fungi. One day last summer (9th June) I met with a number of large chocolate-coloured fungi growing upon the roots and bark of the stumps of some large hemlocks recently felled. Hiding in crevices of the bark, or in the damp chips and leaves from amidst which the fungi on the roots were springing, I discovered numerous specimens of this handsome beetle and collected about thirty, which had been recently feeding upon the fungus, as evidenced by the holes gnawed therein.

The beetles varied much in size, being from four to seven-eighths of an inch long. They are of an elongated oval shape, three times as long as broad. The head, bearing the distinguishing club-tipped antennæ, is inserted to the eyes in the almost square thorax. The beetle is broadest across the base of the elytra, which taper gradually and are rounded off at the tip. Each elytron is marked by two orange patches; the one at the base is somewhat in the form of a Maltese cross with the lower arm broken off, but varies in different specimens; the other is an irregular band about one-third the distance from the tip. With these exceptions the beetle is of a jet black, highly polished, and is a handsome insect. About six weeks later I visited the same locality in the expectation of obtaining some more of these fine beetles, but could find none. In some fresh fungi of the same kind I found numbers of large stout grubs, from one-half to over three-quarters of an inch long, with a broad black band across the top of each segment. They were probably the larvæ of this beetle, but as I did not succeed in rearing any of those I took, and could not visit the place again, they may have been those of some fungi-eating Tenebrio, to some larvæ of which family they had much resemblance.

From the same fungi from which I had previously taken the above-mentioned beetles, and which were now hard and dry, I obtained nearly forty specimens of *Bolitotherus cornutus*, the majority females. This beetle belongs (with the two species next to be described) to the *Tenebrionidæ*, the members of which family live chiefly in or about dead stumps and logs, hiding in crevices or under bark, fungus, and moss. It is a dark brown or dull black beetle, thickly covered with tubercles, so that it looks like a bit of rotten bark or dry earth, and easily escapes detection when it drops to the ground with its legs tightly folded. The male has two horn-like projections upon the thorax and also two minute ones on the front of his head. Those on the thorax are more than an eighth of an inch long, flattened inwardly at the end, and fringed with a light pubescence. The beetles are found abundantly during the summer and autumn, feeding upon the large woody fungi which spring from stumps and decaying trees. While the beetles are found imbedded in holes gnawed in the surface, the larvæ in different stages will be obtained by breaking apart the fungus, in which they burrow out cells until the whole mass is full of holes and tunnels filled with excrement. The grubs are long and cylindrical, attaining when full grown a length of three-quarters of an inch, and have two spines on the last segment, as have the larvæ of many species of this family.

Diaperis hydni is a small stout beetle, a quarter of an inch long, common in fungus growing upon old and decaying beech trees (such as are infested by *Dicerca divaricata* and *Tremex columba).* It is very smooth and glossy, and is jet black with the exception of the elytra. These are light brown, and are marked by two small black dots just behind the thorax and by two larger ones midway between these and the tip. They are also ornamented by lines of minute punctures, hardly visible to the naked eye, and not interrupting the glistening appearance of the beetle.

Hoplocephala bicornis is a little dark greenish beetle, found in great numbers in the dry leathery fungus which grows, like overlapping scales, on hardwood stumps. Although this beetle is less than one-fifth of an inch long, the male may be easily distinguished by the two little spines or horns which he bears on his head, and from which the species derives its name. They soon reduce the dry fungus to a white powdery state.

Mycetophagus punctatus is abundant in the fresh, soft, white fungi which grow from the bark of various trees, not in compact masses, but laminated or gilled beneath like Toadstools. On giving the tree a smart tap, the beetles will shower down from between the gills upon a beating net held below. They are nearly one-fourth of an inch long, and are black, except the yellowish elytra, which are marked by a black spot surrounding the scutel, a black band across near the tip, and two black spots midway between this band and the thorax. Associated with them are generally found numbers of a smaller but very similarly coloured species, *M. flexuosus.*

Similar fungi will sometimes be found to contain a great many very slender little white grubs, with a black head no larger than a pin-hole. I have seen them twisted together in such lumps that the black heads seemed like some tiny mites creeping about over the wriggling mass, in which the respective bodies were lost. These are the larvæ of *Triplax thoracica,* a reddish beetle, one-fifth of an inch long, with blue-black elytra, belonging, like the first beetle described, to the *Erotylidæ.*

Penthe obliquata is a very active beetle, which scampers hastily away when disturbed at its fungus feast or in its hiding-place under bark, and thus frequently eludes its discoverer. It is of a deep dull black, only relieved by the reddish-yellow scutel and a yellow apical joint to the antennæ. The elytra are very densely and irregularly punctured. This fine beetle is half an inch long and almost oval in shape. A rarer and slightly larger, but not so handsome insect, is *P. Pimelia,* which I have found under the bark of old trees. It is of a dull brownish-black, and has the elytra more evenly and less densely punctured. As it lacks the yellow scutel, it is easily distinguished from the preceding species.

Many *Staphylinidæ* are found in the stalks of Toadstools and in other fungi, while those of many other families resort to these productions either for an occasional meal or for a life-long diet. Such are *Cratoparis lunatus* among the Weevils, and *Onthophagus hecate* of the Scarabeans. To even enumerate these would require much space, but I think I have already written enough to show that the young collector will find it profitable to search the different fungi for specimens, especially early and late in the year, when other feeding grounds are unproductive. I might add that many insects in turn fall victims to fungi. The house-fly is a familiar instance of this, and every fall we see great numbers of them stick to our walls and windows, their bodies distended by the fungus, which also spreads some distance around them.

FIELD NOTES—1881.

The earth, covered by its first mantle of snow, reminds one that the collecting season is virtually ended, and the lengthening evenings allure one to the study fireside to go carefully over note-books and collections and to read the recorded labours of fellow-Entomologists.

A few memoranda from my own note-book may perhaps not be barren of interest to some of the less experienced readers of the *Entomologist*. I find that almost the first insect of spring was the Mud-wasp (*Polestes annulatus*), which appeared with a few flies and spiders about the 15th of March. This wasp is very abundant here, and from the pulverized macadam of the streets thousands of its mud cells are constructed every summer under the window-sills and numerous cornices of the Parliament Buildings, about which the wasps linger until the end of October. Toward the end of March a few bees and a number of small beetles, as *Amara interstitialis*, appeared. *Pieris rapæ*, the cabbage butterfly, was observed on April 1st, but from this date to the 8th of the month a severe cold spell (thermometer touching zero) reduced insect appearances to the minimum again. At its conclusion they emerged in still greater variety and number; *Vanessa antiopa* flitted about in sunny glades of the wood; *Cicindela pupurea* enlivened the fields, and its relatives, *C. vulgaris* and *C. sex-guttata*, the roads. Mosquitoes came in full force a fortnight later, and on the 24th I obtained a number of *Buprestidæ* upon young pines, viz., 1 ♂ and 2 ♀ *C. virginiensis*, and 14 ♂ and 13 ♀ *C. liberta*. I was somewhat surprised to find them so early in the year, yet could have taken many more. They were generally paired, in several instances copulating. Great numbers of Saw-flies were also upon the pines. A few days later I captured specimens of *A. striata*, and by the beginning of May all orders of insects were well represented. On the 6th *Serica sericea* was abundant on the foliage of wild gooseberry bushes. *Chrysomela elegans* was also unusually numerous, but I could not find upon what it fed. *Platycerus quercus* was found eating the buds of maples and other trees. The buds were often completely eaten out, and the beetles hidden from view therein. In some buds a male and female were found copulating. This beetle was new to my collection, but I found them frequently again during the summer when using a beating net. During May the curious larvæ of certain *Lampyridæ* were often seen in damp woods, crawling on the trunks of trees, such as cedar, or affixed by the tail to the bark, undergoing their metamorphoses in a similar manner to the larvæ of the *Coccinellidæ*. Some reared at home emerged as *Photinus angulatus*. The larvæ, and to a less degree, the pupæ, emitted a strong greenish glow from two of the posterior segments; the imago being, of course, one of our common "fire-flies." Some of the larvæ were thickly covered beneath with small ticks, of a bright vermilion colour, which had their pointed heads plunged between the armoured segments of the larvæ. They were not easily dislodged, but walked rapidly when free. By these little parasites the larvæ were so weakened as to perish before completing their transformations. The warm weather of mid-May brought forth increased hosts of insects, and the sultry air, especially in the neighbourhood of lumber yards, swarmed with *Scolytidæ*, etc. Toward the end of the month I took a trip, with three friends, to the Wakefield Cave, about twenty miles north of the city, and in my spare moments collected a number of insects in that vicinity. *Cicindelidæ* especially abounded on the sandy hill-side roads, and I captured three species which are rare, or not found about here, viz., *C. 12-guttata*, *C. longalabris*, and *C. limbalis*. On my way back I took a specimen of *C. sex-guttata* having only two spots (the anterior one on each elytron). Although called Six-spotted Tiger Beetles, very many have eight spots, and specimens with ten spots are frequently taken. In a beech grove at Chelsea, *Ithycerus curculionides* was very abundant; several could be seen on nearly every tree; many pairs were copulating. Where do the larvæ live? On the 31st of May several specimens of *C. Harrisi* were taken on pine saplings, and *H. Pales* and its long-snouted relatives were in full force. On June 4th, *Saperda vestita*, *Oberea amabilis*, *B. nasicus*, *C. nenuphar*, *A. quadrigibbus*, and many other weevils, elaters, etc., were noted. At an excursion of the Ottawa Field Naturalists' Club to Montebello (45 miles down the river), on 26th June, I captured 129 species of *Coleoptera*, a considerable percentage of which were new to me. *Carabidæ* were particularly abundant under drift-wood and dead leaves on the damp, shady shore, and 35 species were taken. *Chrysomelidæ*, *Elateridæ*, and *Curculionidæ* were next in number with 15, 13, and 13 species respectively. After midsummer my opportunities for collecting were few, and my notes correspondingly scanty. I will merely mention the capture at Aylmer and Hull, on Oct. 2nd, of *Aletia argillacea argentata*, the cotton moth; both specimens were in perfect order, not in the least rubbed or worn. In October, 1880, I took several specimens about the city, also apparently recently emerged.

CARBOLIC ACID AS A PREVENTIVE OF INSECT RAVAGES.

(Read before the Sub-Section of Entomology of the A. A. A. S.)

By A. J. Cook, Lansing, Mich.

One year ago I gave at the Boston meeting of the Association for the Advancement of Science the results of some experiments in the use of London purple to destroy the codling moth larva, and bisulphide of carbon in fighting the cabbage maggot and squash borer. These experiments have been repeated the present season, and with results no less favourable than those reported one year ago. I think it is an established fact that the methods recommended are valuable. They not only seem reliable, but they promise to be the cheapest and most desirable modes that can be made practicable on all occasions.

As stated last year, the bisulphide of carbon will also destroy the radish maggot *(Anthomyia raphani)*, but owing to the great number of plants to be treated, the amount of the liquid necessary to do thorough work is large, and so the expense is perhaps too great to warrant its use in case of this insect. The present season I tried to see if we might not make the application in a few places about the bed, at some distance apart, and still effect our purpose to destroy the maggots. The result does not recommend this liquid for the destruction of the radish *Anthomyia* with the same emphasis that we may safely give in advising its use for the cabbage *Anthomyia* and the squash *Ægerian*. This fact led me to cast about for some more desirable agent to be used against the radish fly, and it occurred to me that carbolic acid, which is not only very repellant to insects, but also quite as remarkable in retaining its obnoxious odour for a long time, might be made most serviceable in this warfare.

I prepared some of this material as follows: To two quarts of soft soap I added two gallons of water. This was then heated to a boiling temperature, when one pint of carbolic acid (in a crude state) was added. This mixture is then set away in a barrel or other vessel, and is ready for use as occasion may require. I mixed one part of this liquid to fifty parts of water, to be used on the radish plants. It was used by three parties in three places. Mr. Lee used it in the College garden, a student—Mr. E. Hale—used it on a bed specially prepared, and I used it in my own garden. Mr. Lee sprinkled it on the plants, and poured it into a trench made close beside the row of plants. Mr. Hale and myself sprinkled it directly on the plants. Messrs. Lee and Hale made but one application, and found that it kept the insects at bay for about two weeks. Even this proved of no little service. I made the application once every week, and the radishes were almost entirely free from the maggots. My bed was seventy or eighty rods from the other beds. But I caught the flies about my garden, and plants near by, not treated, were badly injured by the maggots. Two cautions should be urged: first, sprinkle the plants as soon as they are up, and thereafter every week or ten days; secondly, the mixture, if sprinkled directly upon the plants, must not be so concentrated as to injure the plants. My experiments this season make me feel certain that this will prove a valuable remedy, and if cheaper, it may even replace the explosive bisulphide of carbon in fighting the cabbage maggot and the squash *Ægerian*.

About my house at the Michigan Agricultural College I have planted a little apple orchard of eight trees. The trunks and larger branches of these trees have been thoroughly washed twice each spring, the last week of May and the last week of June, with soft soap. A neighbour but a stone's throw distant set out some fine primates about the same time that I set out my trees. He does not believe in the use of soft soap, practically at least, and his trees are sorely disfigured and greatly injured by the *Saperda candida* and the *S. cretata,* while my trees are smooth and admired by all. I have some pear trees in the same orchard which were not treated with the soap, one of which has been much injured by the borers.

This year I used the undiluted carbolic mixture instead of the soft soap. I fully believe this to be an improvement on the soap alone, as in some cases, if but one or even two applications of the soap are made, the effect is not so long continued as to entirely prevent the borers from egg laying. The carbolic acid will tend to extend the period, so that I believe two applications will in every case repel the beetles.

ENTOMOLOGICAL PAPERS.

By James T. Bell, Belleville, Ontario.

Arboreal Auscultation.

Some time ago, while visiting the Dean and Williams Gold Mine, in the township of Marmora, I was interested in observing the proceedings of some woodpeckers which resorted to some half-dead pine trees in front of my room window. I remarked that after alighting they would run upwards in a zigzag way, stopping occasionally, and applying the side of their heads to the tree, evidently listening for the noise made by a grub while gnawing the wood. Suddenly a bird would begin to dip into the bark, the rapid strokes of its powerful bill making the chips fly faster than a lumberman's axe. On one occasion, by the aid of an opera-glass, I saw one fellow transfer something large and white from the cavity he had excavated to the interior of his craw, but the quickness of the action prevented me from ascertaining precisely what it was.

Thinking of this, it has occurred to me that the presence of a "borer" in a fruit or other tree might be ascertained in the same manner by the use of a tube of wood or tinplate formed like a stethoscope or ear-trumpet; by applying the wide end to the tree and the small end to the ear, the exact locality of the grub could be determined, when the application of a stout brad-awl or small gimlet would put an end at once to his life and his depredations without material injury to the tree.

How we Captured a Hornet's Nest.

One fine day last October, while enjoying a ramble in the woods near Belleville, with two of my sons, one of them took hold of a knot which projected from a small half-decayed log, intending to turn it over to search for beetles beneath it. The piece, however, came away in his hand and disclosed the entrance of a nest of black hornets. Of course we retreated "at the double" before the disturbed insects recovered from their first surprise, leaving them to settle down at their leisure. A few days after, taking advantage of a cool morning, I sent my two boys to the wood with a small bottle of chloroform and a hard rubber syringe. According to directions, they injected about a drachm of the liquid into the hole, and threw a handkerchief over the entrance. In about five minutes they opened up the nest, when they found the inmates in a perfect state of slumber, and transferred them without trouble to their cyanide bottles. In about an hour they returned, bringing me forty-eight specimens of the insect.

Collection Notes for 1880.

The early months of 1880 were especially favourable to the acquisition of the hybernating Coleoptera, and those which have their permanent habitat among the moss of our woods and swamps. The early disappearance of the snow laid bare their hiding places, while the frosts which succeeded formed an ice-bridge which gave access to their places of refuge, which in ordinary seasons remain covered with snow till the general break-up of the winter, when they are rendered inacessible by being surrounded or covered with water. Mr. J. D. Evans and myself, who are the sole representatives of the Entomological Society in this district, took advantage of these favourable circumstances and commenced a vigorous course of moss-hunting, lasting from March 1st to May 24th. During this period we collected upwards of 1,000 specimens of over 100 species, of which the following are not included in the Society's published lists. The numbers are those of Crotch's Check List, and the determinations, with few exceptions, were made by Mr. H. Ulke, of Washington, and Mr. E. P. Austin, of Boston :—

7496	Anchus pusillus.
	Hydrochus (nova species, Ulke.)
1579	Trichopteryx Haldemanni.
	“ 2 sp. (nova species, Ulke.)
2102*a*	Pselaphus longiclavus.
2110	Bryaxis conjuncta.
2120*a*	B. propinqua.
2134	Decarthron formiceti.
2139	Arthmius globicollis.
2295	Scydmænus bicolor.
	“ 2 species not determined.
2366	Latridius deletus.
2572	Atomaria ochracea.
5670	Xanthonia Stevensii.
5771	Plagiodera cochleariæ.
6294	Paratenetus gibbipennis.
9027	Tanysphyrus lemnæ.
9298	Ceutorrhyncus semirufus.
1818	Philonthus palliatus.
7749	Stilicus biarmatus.

All the above were taken from moss, and in addition the following, which are already registered as Canadian: 2095, 2100, 2102, 2103, 2113, 2124, 2130, 2149, 2150, 2164, 2283, 2285, and about 70 species of Carabidæ, Staphylinidæ, Chrysomelidæ, Curculionidæ, etc.

3932 Alaus gorgops ; from a stump in Bleecker's Woods.

On June 7th we experienced a heavy gale from the S.W., and on the 12th one of my daughters, who was visiting at West Lake, Prince Edward County, went with a picnic party to the Sand Banks, on the shore of Lake Ontario. There she found the beach strewn with Calosomas and other Coleoptera. On her return she brought me 16 *C. scrutator*, 13 *C. Wilcoxi*, 1 *C. frigidum*, and many other beetles. On July 1st, Mr. W. R. Smith being at Brighton, found on the beach at Presq' Isle a similar display of Calosomas, and brought me 14 *C. scrutator*, 24 *C. Wilcoxi*, and 3 *C. frigidum ;* unfortunately most of them were spoiled from exposure.

On June I had brought to me a rather fine specimen of *Eacles imperialis* and a good male of *Xyloryctes satyrus*, both taken within half a mile from the city limits.

With these exceptions, the season of 1880 has proved the least favourable to the Entomological collector, in this quarter at least, of any I have experienced in my 21 years' residence in Canada. Very few Lepidoptera were seen, either on the wing or at sugar; beating the bushes was singularly unproductive, and I have more than once picked stumps and turned over stones for a full hour without getting 20 specimens of all sorts.

NOTES ON A PARASITE—ON THE PAINTED LADY BUTTERFLY (*Pyrameis Cardui*).

BY CAROLINE E. HEUSTIS, CARLETON, ST. JOHN, N.B.

I send you a few specimens of an insect which I have found parasitic on the larvæ of *P. cardui*. For several successive summers I have reared a number of these caterpillars, with which our thistles in most seasons abound. I observed variations in size and colour of the larvæ found feeding on the same plant, which led me to suppose that they might not belong to the same species. I have always observed that a large proportion were almost black, and much smaller than those from which I have obtained good specimens of *cardui*, but until the last summer my efforts to raise these were not attended with success, all the small black larvæ dying before they had attained their full growth, although they fed well for a time.

Last season I collected from a group of thistles of the same species fifteen caterpillars, and put them in breeding boxes. They all ate voraciously, and one after another went into chrysalis, except two, which died on the bottom of the box, after having made several ineffectual efforts to suspend. Those which died were black. I carefully marked those which I suppose other than *cardui* as they suspended, and watched for the advent of the butterflies. I observed that the chrysalids of the black specimens were bright golden, and smaller than those of the bright and healthy-looking larvæ. The chrysalids of the latter were grey, ornamented with white stripes along the sides. (This insect has been kindly determined by E. T. Cresson, of Philadelphia, as *Ichneumon rufiventris*).

ENTOMOLOGICAL NOTES.

BY J. ALSTON MOFFAT, HAMILTON. ONT.

Calosoma Scrutator.—In connection with Mr. Fletcher's interesting article on "*Calosoma Scrutator*, the Beautiful-bodied Searcher," in our last Annual Report, I desire to relate my experience with this insect during the summer of 1881. On 11th June I left Hamilton for Long Point. I had half a day to spend at Port Dover before the boat left. About noon a strong breeze sprung up from the S.W., which drove the waves up the shore. I took a stroll along the beach, and had not gone far when I saw a greenback just landed, making rapid strides with his long legs away from the water, and I seized my first living *scrutator*. I took several of them that afternoon alive, some of them simply that and nothing more. At Long Point the evidence of what had been was unmistakable; the water lines of various storms of different forces were marked with bands of green wing-covers. I was too late for the harvest, very few coming ashore while I was there. When sugaring for moths we took from 2 to 5 every night, and one night 16. A large gauze-winged fly was attracted in great numbers to the sugar, and the *scrutator* was attracted by them, for in almost every instance we took them with one of these in their jaws. When seized they would drench the fingers with an acrid fluid of the most offensive odour; it was very volatile, drying rapidly with a sensation like alcohol. In one instance I took one from under a board on the beach, and in blowing off the sand that adhered to it some of the fluid struck my lip; it burned for an instant sharply. The odour from them leaves in a very short time. Does it not seem strange they should remain so scarce in the country when they are landed in such numbers on our shores alive? A friend, Mr. A. H. Kilman, of Ridgeway, writes me that they came ashore this spring after a south-west storm in hundreds, dead and alive. And we may suppose it to be about the same along the whole north shore of Lake Erie, and yet I know of but three taken in the neighbourhood of Hamilton in 20 years.

Saperda Fayi.—On the 11th of June I took a pair of *Saperda Fayi* upon thorn, a rather rare insect with Canadian collectors hitherto, I believe. Ten years ago or more I captured one, and had not met with it since, but this year amidst a general scarcity it seemed to be quite abundant here, the different collectors finding it well represented in every direction around the city. One day, coming on a favourable locality, I took 19; returning to the same place the following afternoon, I got 30, and had to leave before 4 o'clock on account of rain—going back a few days later and securing 34. I found old bushes in an exposed situation the most productive.

Papilio Cresphontes.—On the 6th Oct., 1880, I took six *cresphontes* larvæ feeding on prickly ash. Some of them fed for several days afterwards, and in due time they all transformed to chrysalids. Now they have all emerged as butterflies; the first appeared on the 22nd of March, the last on the 17th of April, 1881. They measure from 3¾ to 4½ inches in expanse of wing, perfect in form and rich in colouring.

Heliothis Armigera Hub.—It seems rather strange that this, so common an insect in many parts, should have been but noticed here for the first time this season. Widespread in the range of its habitat, having been taken in England, Australia, and Japan, it is also pretty general in its feeding, accommodating itself readily to the conditions of the locality. The caterpillar known by the name of the boll-worm in the Southern States, from the vast amount of injury done by it in eating into the cotton-boll, is known in the Western States as the corn-worm, but has been found also in other countries to be very destructive in the field to green peas and pumpkins, and in the garden to tomatoes and the gladiolus. If it should become permanent amongst us and abundant, it will be no small addition to the band of enemies which our cultivators of the soil have already to contend with. The late B. D. Walsh, M.A., the much-lamented State Entomologist of Illinois, writing of it in 1869, says, "It attacks corn in the ear, at first feeding on the silk, but afterwards devouring the kernels at the terminal end, being securely sheltered the while within the husks. We have seen whole fields of corn nearly ruined in this way in the State of Kentucky, but nowhere have we known it to be so very destructive as in Southern Illinois." Again he says, "In 1860, the year of the great drought in Kansas, the corn crop in that State was almost entirely ruined by the corn-worm. According to the *Prairie Farmer* of Jan. 31st, 1861, one county there, which raised 436,000 bushels of corn in 1859, only produced 5,000 bushels of poor wormy stuff in 1860; and this, we are told, was a fair sample of most of the counties of Kansas." In these extracts we have evidence of its powers of devastation when abundant. In these States it is double-brooded; whether it is so here or not does not yet appear certain, but that it is double-brooded in New Jersey has been most conclusively proven by the careful investigations of Mrs. Mary Treat, of Vineland, N. J. It was quite plenty here in the early part of September, feeding in the daytime on the flowers of the golden-rod and in the gardens. Several of the *Agrotis* family were flying at the same time, which are known to be but single-brooded. The probabilities are that it may be the same here also. A night-flyer properly, or in the dusk of the evening, it seemed to have been tempted from its hiding-place by that peculiar dull, smoky weather we had so much of during the first three weeks of September, when even the Sphingidaa forgot their usual caution and came forth boldly to feed at mid-day, having taken a tomato-sphinx *(M. Quinquemaculata)* at 2 o'clock in the afternoon of the 14th, feeding on petunias, whilst the white-lined sphinx *(Deilephila lineata)*, which, by the way, was most unusually abundant, could be seen by the half-dozen among the flowers at any time of the day. The Heliothis moth is a pale clay yellow on the front wings, but quite variable in depth of shading, with olivaceous markings and a conspicuous dark spot near the middle. The hind wings are paler, with a dark brownish band on the outer margin. Being about 1¾ inches in expanse of wing, it was quite a conspicuous object while feeding, more especially as it seldom rested, but kept its wings amoving the while. The caterpillar is said to vary in colour from a pale green to a dark brown, but the ornamentation is constant, which is longitudinal light and dark lines, and black spots from which rise a few soft hairs.

FOOD HABITS OF THE LONGICORNS.

By F. B. Caulfield, Montreal, P.Q.

In June, 1873, while collecting in a small swamp on Montreal Mountain, I caught a specimen of *Pogonocherus mixtus* (Hald.) on my coat-sleeve, and as the insect was new to me I commenced a search for others. Upon examining a dead branch of a small willow growing close by, I found that it had been extensively bored by some small insect. The part attacked was about three feet from the trunk, and at this place the branch, for about twelve inches, was full of holes from which the insects had escaped. Not finding them, I searched further along the branch, and near its extremity, where it was reduced to the thickness of a twig, I found a number of the above-named species. They were lying on the branch with their bodies pressed closely against it, and in this position could with difficulty be distinguished from the withered buds. I observed several pairs in coitu, but none of the females were ovipositing. They appeared to be very sluggish, lying almost motionless, although the sun was shining brightly at the time. Having bottled all that were to be seen, I cut off the branch where it had been perforated, and found a number of the beetles in it, but neither larva nor pupa.

Gaurotes cyanipennis (Say).—I find this insect in spring on thorn blossoms, and later in the season pairing and ovipositing on butternut.

CUPES CAPITATA.

By E. Baynes-Reed, London, Ont.

For some years past I have been, during the month of July, in the habit of collecting specimens of this pretty little beetle on the fence of a churchyard adjoining my residence. This year they were exceedingly numerous, and I captured in four days over 80, of which some 50, were females. It is curious to note that I have invariably found that certain pickets of the fence were selected by the beetles, and that out of a long distance of fencing round the sides of the church, these few pickets on one side would be the only place to find the beetle. I can give no reason for such selection—the trees and food plants round the fence are similar ; they congregate for breeding purposes and then suddenly disappear, and can only be rarely found afterwards.

NOTES ON LYTTA (BLISTER-BEETLES).

By Prof. E. W. Claypole, Yellow Springs, Ohio.

During the present summer three species of *Lytta* have been very abundant and destructive here. The Striped Blister-beetle *(Lytta vittata)* in the early part of the season, about the end of June, began to do mischief to the potato plants, especially where they were weedy. Later on, about the middle of July, this species was joined by the White-edged Blister-beetle *(L. marginata)*, and both together fell upon the later kinds of potato (in my garden the Buckeye). Now (August) the Black Blister-beetle *(L. atrata)* may be seen in company with the former two where a few belated plants afford them any green fodder. The last mentioned of the three, however, did not arrive in time to do any serious harm to the potato, but turned its attention to a large bed of sunflower belonging to my children, and are preying upon their yellow petals greedily. From twelve to twenty may be often seen upon a single plant.

All these three species "play 'possum" when frightened, but not all in the same way. The black one drops from the plant as does the Colorado Beetle *(D. 10-lineata)*, but does not fold in its legs and antennæ and roll about. It lies just where it falls for some seconds, with limbs in the position in which they were when it dropped. The white-edged and striped species fall as if struck dead, but always alight on their feet or gain them immediately, and stand looking warily about them. If no danger seems near, or if an attack is made upon them, they run, and having the longest legs of the group, they run fast and are difficult to catch. But their bodies being soft they are easily crushed. Their juices, as their name implies, are exceedingly blistering, and soon raise a water blister on the skin if applied to it. Hence they are often used locally as a substitute for the Spanish Fly.

The presence and voracity of these Blister-beetles make it very difficult to keep a bed of potatoes clean by hand-picking of any kind, but of course Paris Green or London Purple is as destructive to them as to the Colorado Beetle, and forms the best remedy. They are so wary that it is almost enough to clear the plants if one walks between the rows so that one's shadow falls on them. They may be seen dropping to the ground in a shower.

Though these three species are so abundant here, I have not seen a specimen of the fourth member of the group, the Ash-grey Blister-beetle *(L. cinerea)*, this summer, and a row of English Broad Windsor Beans which I planted as an experiment were quite untouched by them. The late Mr. Walsh says he never could grow these beans at Rock Island, Ill., because of the swarms of Ash-grey Blister-beetles which ate them up. My broad beans were, however, badly injured by numbers of a small black hopping beetle, the name of which I do not know, but which treated their leaves exactly as the Turnip Flea Beetle treats the seed leaves of the young turnips. It was, however, much larger.

Not to paint the Black Blister-beetle any blacker than is just right, I must add that I not long ago found a swarm of them devouring the flowers of the great rag-weed *(Ambrosia trifida)*. One of them, which I watched for some time, cleaned the whole of the flowers from one of the involucres of the raceme in a few seconds.

THE COLORADO BEETLE.

The following extract from an English newspaper, the *Bristol Mercury*, will show how carefully the Colorado Beetle is looked after in England, and how great a risk he runs if he sets foot within the United Kingdom. He is far more sternly outlawed than was Robin Hood or Smith O'Brien, and if only a suspicion of his presence is felt, all, from the Privy Council downwards, are up in arms to crush him with all the terrors of the law. Let us hope they will succeed in making the country too hot for even the ten-lined Spearman :—

"Mr. Borlase put a question as to the discovery of a Colorado Beetle in South Devon.

"Mr. Mundella answered, saying the Colorado Beetle was in his department. (A laugh.) He then gave the facts of the discovery of a live Colorado Beetle in the possession of a man at Yealmpton, who refused to give it up. Upon instructions from the department he was prosecuted under the Destructive Insects Act of 1877, and fined the mitigated penalty of £5, he pleading ignorance of the law and agreeing to the destruction of the beetle."

ENTOMOLOGICAL NOTES FOR THE SUMMER OF 1881.

I came only last year to the premises where I am now residing, and though I had a small crop of cherries, they were so badly infested with the weevil (*Canotrachelus nenuphar*) that only a few quarts could be found free from the grub and fit for canning. This year a fair crop was promised ; the spring was late and the danger of the frost little. I proposed, therefore, to make war upon the enemy, and as soon as the blossom was over prepared a large sheet of cheese-cloth, and for about three weeks jarred the trees before breakfast almost every morning. As the result, I have now nearly 2,000 weevils peacefully reposing in a bottle, after a composing draught of benzine. Only about 10 per cent. of my cherries this year were unfit for use. I carried the war into the orchard, and, simply by way of experiment, jarred some of the early apple trees and captured a great many of my enemies. I am more than repaid for my labours both on the cherry and apple trees, by the quality of the apples. When last year, with a larger crop, I only obtained knotty, gnarly fruit, I have this year round, smooth, well-shaped apples. I have never heard that anything has been done, at least in this neighbourhood, to trap the weevils on the apple trees. Those who live in the north have no idea of the mischief wrought here by the weevil in the orchards.

A word for the mole. In digging potatoes this year, I observed the runs of a mole in all directions through the ground. It was a piece of old sod, and very much infested with white worms, the larvæ of the Cockchafer (*Lachnosterna fusca*). Many of the potatoes had been partly eaten by these worms, but I observed that wherever a mole-run traversed a hill of potatoes no white worm could be found, even though the half-eaten potatoes were proof of his former presence. The inference is fair that the mole had found him first and eaten him, and very likely the mole's object in so thickly tunnelling this piece of ground was to find these grubs.

Now, it would be very easy to trump up a charge against the mole on the evidence of these facts. There was the "run" which nothing but a mole could make, and there were the gnawed potatoes; put the two together and kill the mole. Many a man has been punished on less conclusive circumstantial evidence. But it is perfectly easy to distinguish the work of a mole from that of a white worm, if one will only take the pains. I have many times found the latter coiled up in the potato he was eating, but I have never seen the mark of teeth such as the mole possesses on a potato. Nor do I believe the mole ever meddles with potatoes or corn.

Abundance of Certain Insects.—The Southern Cabbage Butterfly (*P. protodice*) is exceedingly abundant here this summer. I have been able to count scores on the wing at one time.

The Potato Worm, or larva of *S. 5-maculata*, is troublesome on the late potatoes this month (September), and soon strips a plant of its leaves. However, he is easily dealt with, as he is at once betrayed by the casting on the ground, and a little "poison dust," such as I use for the beetle, soon makes an end of him. I have tried "Buhach" on this insect, but find the former much easier of application and more effective. The latter diluted with ten parts of flour had little effect on the worms, but when used neat it stopped their feeding and killed two of them in a couple of days. But there is the trouble of looking up the creature (green on a green ground) in order to put the powder "where it will do the most good," whereas one need only shake the powder-tin over the plant and pass on, leaving the worm to poison itself.

The same is true of the Cabbage Butterfly (*P. rapæ*) in the early stages of growth of the cabbage. I have used Buhach, and a friend of mine is now using it on a plot of 3,000 heads of cabbage, but the time spent in finding the green worm on the green leaf is a serious drawback, and while the plant is very young I prefer using the "poison dust." I can sprinkle a whole bed while I am finding the worm on a dozen cabbage-heads in order "to put salt on his tail." The "poison dust" to which I refer is made by mixing one part of London Purple and sixty parts of ashes, and passing the mixture several times through a fine sieve. I may add, that I find this a very efficient remedy for the turnip fly.

BOOK NOTICES.

THE CANADIAN SPORTSMAN AND NATURALIST, Vol. I., Nos. 1 to 8.

This is a monthly journal published in Montreal, and edited by William Couper, a well-known naturalist and sportsman. Each number contains eight pages of matter arranged in double columns, printed in first-class style and on good paper. The articles are short and interesting, treating mainly of matters pertaining to hunting and fishing, with brief descriptions of Canadian wild animals, birds, etc.

The editor's extensive experience and travels in the Lower St. Lawrence is manifest in his articles on the rivers of that district and their products. Entomology also comes in for a share of attention. The fifth number contains a valuable contribution from Dr. J. H. Garnier, of Lucknow, Ont., on the Reptiles of Canada, a subject to which but little attention has yet been given in this country, but one in which there is a large and promising field for the enterprising investigator. To all lovers of sport, either with the rod or gun, this journal will commend itself. It should also be of value to all who are fond of natural history in general. We hope to see it liberally supported. The subscription price is one dollar per annum.

BUTTERFLIES: THEIR STRUCTURE, CHANGES AND LIFE HISTORIES. By Samuel H. Scudder.

We are indebted to the author for a copy of this beautiful book, a well-printed octavo volume of 322 pp., illustrated with 201 figures. The work is divided into thirteen chapters, the first six of which treat of the structure of butterflies in all the stages of their growth from the egg to the perfect insect. A chapter is devoted to the internal organs of caterpillars, and another to the transformation of these organs during growth. The remaining chapters deal with the life histories of these attractive insects and the changes which they undergo under varying circumstances. Following these is an Appendix containing instructions for collecting and preserving insects, etc., a list of the common and scientific names of butterflies, and a list also of the food plants of their caterpillars, all written in a plain and popular style. It is a great pity that a work of this character, coming from so well-known and talented an author, and containing as it does so much useful and valuable information, should be marred by the introduction of a series of new names for our butterflies, which, to the great bulk of the Entomologists of America, seems to be a most unreasonable imposition, and against which there is a general feeling of revolt. That any author should persist in carrying the rules of priority so far as to resurrect old documents, the authority of which is of the most questionable value, and on the strength of these insist on the changing of nearly all the names of our butterflies, is a tax on the patience of the practical man which few can endure, and a serious bar to the progress of our favourite science. Neither do we think that the introduction of a large number of newly-invented common names will add in any degree to the popularity of Entomology; it were far better, in our opinion (with few exceptions), to use the specific name of the insect for this purpose, which is as easily learnt and conveys a more definite idea than is possible with such common names as those given by this author.

PAPILIO.

This valuable monthly serial, devoted entirely to Lepidoptera, has now reached its ninth number, with an average of about 20 pages per number. It is the organ of the New York Entomological Club, is well got up as to printing and paper, and is edited by the Secretary of the Club, Mr. Henry Edwards. A large portion of its space is devoted to descriptive Entomology, with occasional papers relating to the life history of species. In the September number, among other interesting papers, we find one by Mr. W. H. Edwards on the alleged abnormal peculiarities of *Argynnis myrina*, which was read before the Subsection of Entomology at the recent meeting of the American Association at Cincinnati. In this paper the author shows from records of careful observation that many of the remarkable statements made by Mr. Scudder on the abnormal peculiarities of this insect are incorrect. In the October number is a full description of the preparatory stages of *Thecla Henrici*, by the same author; notes on an Aquatic Noctuid Larva, by J. H. Comstock; and descriptive papers by A. R. Grote, B. Neumoegen and Henry Edwards.

BULLETIN NO. 6, FROM THE DEPARTMENT OF THE INTERIOR, U. S. ENTOMOLOGICAL COMMISSION; being a General Index and Supplement to the Nine Reports of the Insects of Missouri. By C. V. Riley; 8vo., pp. 177.

This useful pamphlet will add much to the value of the Missouri Reports, containing as it does a very complete index to all the matters contained therein. Following the introduction we have tables of the contents of the nine reports, then a list of errata, followed by a few pages of notes and additions; then follow descriptions of new species, descriptions of adolescent states, lists of illustrations, a copious general index and an index to plants and food plants.

ON THE GENERA OF CARABIDÆ, with Special Reference to the Fauna of Boreal America. By George H. Horn, M.D. From the Transactions of the American Entomological Society, October, 1881; 105 pp., with eight plates.

In this paper the author dwells at some length on the value of the modifications of various organs of the body in the Carabidæ, for the purposes of classification, following with a complete classification of the tribes in this order, the points of difference being illustrated by examples in the excellent plates which accompany the text. Throughout this work there are many tables wherein the main points of difference are grouped in such a manner as to enable the student to readily recognize the many genera into which our numerous species are divided. This addition to our Entomological literature will prove a great help to Coleopterists, and only those who know the extent of this subject will be able to estimate the amount of labour and careful study required to produce such a work as that we have before us.

THE HONEY ANTS AND THE OCCIDENT ANTS. By Henry C. McCook, D.D.; 8vo., pp. 188, illustrated with thirteen plates. 1882.

This work, in the words of the author, is "a monograph of the architecture and habits of the honey-bearing ant, *Myrmecocystus melliger*, with notes upon the anatomy and physiology of the alimentary canal; together with a natural history of the Occident harvesting ants or stone-mound builders of the American plains." It is written in a charming and popular style, and the details of the curious habits of these interesting creatures are given in such a manner as to show that the author has studied them closely, and is quite familiar with every aspect of the subject treated of, while the beautiful illustrations are a material aid towards the ready comprehension of the whole matter. This work is well worthy of a place in the library of every student of nature.

A MANUAL OF INJURIOUS INSECTS, with Methods of Prevention, and Remedy for their Attacks to Food Crops, Forest Trees and Fruit, and with a short Introduction to Entomology. By Eleanor A. Ormerod, F.M.S., London, England. 1881.

It is with very great pleasure that we draw attention to Miss Ormerod's excellent work on Injurious Insects—the full title to which we have given above. It is the first effort that has been made in England to bring within the reach and comprehension of ordinary farmers and gardeners a complete account of the insect enemies that they have to deal with. The work begins with an introduction to Entomology, in which the reader is furnished with an account of the general life-history of insects during the various stages of their existence, beginning with the egg and going on through the larva and pupa to the imago. This is followed by a sketch of the classification of insects, based upon Prof. Westwood's division into thirteen orders, each of which is represented by wood-cuts of common species, in order that it may be easily recognised by the reader. The book is divided into three parts, viz., Food Crops, Forest Trees and Fruit, with the insects that injure them respectively. In each part the various crops, trees, etc., are treated of as regards their insect enemies, in alphabetical order; for instance, the "Food Crops" begin with the Asparagus, Bean, etc., and end with Turnips, thus making it very easy to obtain information about any insect that happens to be prevalent. Every insect treated of in the book is made easily recognisable to the non-scientific reader by means of admirable wood-cuts, partly the work of the talented authoress herself, and partly reproductions of the beautiful illustrations in Curtis' Farm Insects. Each cut shows the insect in the various stages of its existence, while the letterpress gives an account of its life history. As an example of Miss Ormerod's work, we give two illustrations selected almost at random.

P. 1, Asparagus Beetle—*Crioceris asparagi*, Linn.

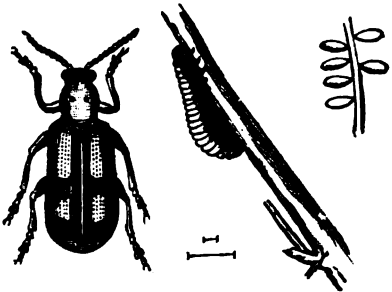

Fig. 10.
Asparagus Beetle, larva and egg; all magnified. Natural length of egg and beetle shown by lines.

P. 123, Onion Fly—*Anthomyia ceparum*, Bouché.

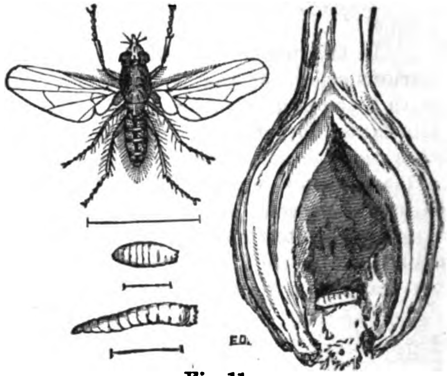

Fig. 11.
Onion Fly, pupa and larva, all magnified. Onion-bulb showing pupa remaining in stored onion.

We cannot but congratulate Miss Ormerod upon the skilful manner in which she has accomplished her task, and we trust that her work will be fully appreciated by the farmers and gardeners of Great Britain, for whose special benefit it has been produced. The whole book is written in clear, simple language, free from all scientific terms and technicalities so far as they can be omitted, while the modes of prevention are such as have been practically tested by competent persons, and cannot fail to be beneficial if intelligently followed. We hope to see many editions of the work called for, and to learn that the authoress has been amply rewarded for her labour of love.—C. J. S. B.

Reports of the U. S. Commissioner of Agriculture for 1878 and 1879.

We have lately received copies of both of these valuable reports from the Department of Agriculture at Washington. There are in them—in addition to all the other useful papers on subjects relating to agriculture—in the reports of the Entomologist of the Department, much that is of great interest to entomologists. In the report for 1878 we have, from the pen of C. V. Riley, contributions on the insects injurious to the cotton plant; the silk worm, with instructions for the production of silk; with descriptions also of a number of insects injurious to fruits and field crops, occupying in all 50 pages, and illustrated by seven full-page plates. In 1879, papers by J. H. Comstock on the army worm, clover insects, insects injurious to the orange tree, and references to many other species which injure field crops, forest and fruit trees, covering 75 pages, and illustrated by six full-page plates. This volume also contains an extensive report on insects injurious to the cotton plant; 84 pp., with 9 plates.

North American Moths; with a Preliminary Catalogue of Species of Hadena and Polia. By A. R. Grote; 8vo., 20 pp., from the Bulletin of the Geological and Geographical Survey of the U. S., Vol. VI., No. 2.

In addition to the catalogues and other useful matter, this paper contains descriptions of twenty-eight new species.

The Insects of the Clover Plant. By J. A. Lintner; 8vo., 17 pp., with 6 cuts.

This excellent paper forms part of the Fortieth Annual Report of the New York State Agricultural Society, and contains detailed descriptions of the insects most destructive to clover, with references to all the species known to feed on this plant.

Ottawa Field Naturalists' Club.

The second volume of the Transactions of this active body of naturalists is at hand. It is a neat pamphlet of 44 pages octavo, with one excellent plate illustrating a new species of *Porsocrinus* from the Trenton limestone, accompanied by a description, with some remarks on the genus by Dr. James Grant. In addition to the Annual Report of the Club, the volume contains the inaugural address of the talented president, James Fletcher, Esq.; a paper on Some Coleoptera Injurious to our Pines, by W. H. Harrington; one by Prof. J. Macoun on the Capabilities of the Prairie Lands of the Great North-West, as shown by their Fauna and Flora; and other interesting contributions. We congratulate our Ottawa friends on the good work they have done this year, and sincerely hope that their active efforts may have the effect of promoting a general love for natural history among the residents of the capital of our Dominion.

INSECTS INJURIOUS TO CLOVER.

By Wm. Saunders, London, Ont.

1. The Clover Seed Midge—*Cecidomyia leguminicola.*
2. The Clover Root Borer—*Hylastes trifolii.*
3. The Clover Stem Borer—*Languria Mozardi.*
4. The Clover Leaf Midge—*Cecidomyia trifolii.*
5. The Clover Hay Worm—*Asopia costalis.*
6. The Clover Drasteria—*Drasteria erechtea.*
7. The Clouded Sulphur Butterfly.—*Colias philodice.*

There are many insects which injuriously affect this important crop, but it is only within the past three or four years that special attention has been paid to them. Within this period they have been closely studied, both in the field and in confinement, by men in every way qualified for the work; by the Entomologists of the Department of Agriculture in Washington, Professors Riley and Comstock; by the State Entomologist of New York, Prof. J. A. Lintner of Albany, and others. From the several valuable reports issued by these Government and State officials, much of what follows has been gleaned; and the object aimed at here is to present the information obtainable in a popular manner, to incorporate with it such additional facts in reference to the occurrence of these insects in Ontario as our limited opportunities for observation have enabled us to acquire, and to present all in as convenient a form for reference as possible, so as to make this part of our report of special value to our agricultural readers.

In a late paper on Clover Insects, published by Mr. Lintner, he enumerates no less than forty-six injurious species, about half of which are known to occur in Canada. The injury done by some of these is insignificant, either on account of the insects feeding on many other plants besides clover, or else for the reason that these species seldom occur in any remarkable abundance; while, on the other hand, there are included in this list several insects which have already become, or promise to become, formidable foes to this crop; and amongst the latter, none are attracting so much attention as the Clover Seed Midge, an insect which has fairly established itself in our country, and is likely to prove a serious drawback to the growth of clover seed in our Province. This species will first claim our attention.

THE CLOVER SEED MIDGE—*Cecidomyia leguminicola*, Lint.

The first mention we have of this serious pest is in an article published in the organ of our Entomological Society of Ontario, the *Canadian Entomologist*, in March, 1879, contributed by Professor Lintner. Under the heading of "A New Insect Pest," he says: "In the summer of 1877 my attention was called to some 'worms' which had been discovered in the heads of red clover (*Trifolium pratense*), and were said to bo preying upon the seeds. They were found to be minute maggot-like creatures hidden within the seed-pods, and entirely destroying the seeds which they attacked. Numbers of them were subsequently detected in the examination of heads of clover taken from several localities in the vicinity of Albany and in Warren County, N.Y. I was unable at the time to refer the insect to any described species, or to find any record of a similar depredation on clover seeds in this country or in Europe.

"The following season (1878), additional examples of infested clover heads were submitted to me which had been sent from Mr. George W. Hoffman, President of the New York State Agricultural Society, from Elmira, N.Y. A number of the larvæ were obtained from these heads, and their careful examination enabled me to refer them to the *Cecidomyidæ*—of a species probably closely related to the well-known Wheat Midge (*Cecidomyia destructor*). Several of the larvæ were preserved in alcohol, and the larger number placed in a pot of damp sand, in which they speedily buried themselves for their transformation." These larvæ were of a pinkish colour, approaching orange, and about one-twelfth of an inch long. In January of the same year, Prof. Lintner had announced the appearance of this new destructive insect at the Annual Meeting of the New York State Agricultural Society, and the discussion which followed brought out the information that this insect had committed serious depredations on clover seed in several counties in western New York during the previous summer, so that fields in some sections which had been kept for seed proved to be scarcely worth cutting. In July of the same year, Mr. Lintner, in another communication to the *Canadian Entomologist*, announced the discovery of the perfect insect which he had reared, and it proved to be—as he supposed it would—a small fly, a species of *Cecidomyia*, to which he subsequently gave the name of *leguminicola*. Observations since made enable us to complete its history.

How it Spends the Winter.

The insect passes the winter in the pupa or chrysalis state either on or under the surface of the ground, and early in spring the fly escapes, when the sexes pair and the female soon becomes ready to deposit her eggs.

The Egg.

The female, by means of a long ovipositor (see fig. 13, *c*), pushes the eggs down the hairy tubes of the undeveloped flowers in the young clover heads almost as soon as the flowers begin to form, which in Ontario would be during the early part of May. The eggs are so small that it is almost impossible to discover them with the naked eye, their length not exceeding the hundredth part of an inch. They are of a long, oval form, three times as long as broad, with one end slightly larger than the other. They are of a pale yellow colour when first laid, but become tinted with orange as the larva within matures; they are usually deposited singly, but sometimes in clusters of from two to five—as many as fifty eggs have been counted in a single flower head. No estimate has yet been made, to my knowledge, of the number of eggs which a single individual is capable of producing, but doubtless this insect is very prolific. In about ten days the eggs hatch, when the young larva works its way down the tube of the flower to the seed, upon which it feeds.

The Larva, or Grub.

The larvæ when full grown are about one-twelfth of an inch long, usually of a bright orange-red colour, occasionally paler and sometimes almost white. They are footless, and have a wriggling, worm-like motion; they affect the clover heads in the same manner that the Wheat Midge affects the wheat, and when mature they leave the clover heads, drop to the ground, and either work themselves a short distance under the ground or hide amongst dead leaves or other rubbish on the surface, and there enter upon the pupal stage of their existence. Figure 12 represents the larva highly magnified, the hair line at the side showing the natural size; at *b* the head is shown retracted, and more highly magnified.

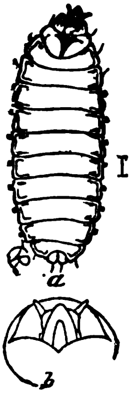

Fig. 12.

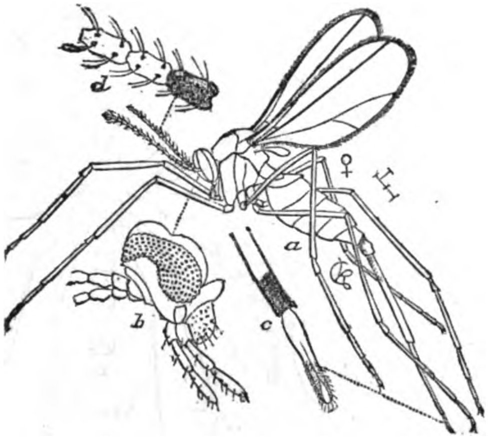

Fig. 13.

THE PUPA, OR CHRYSALIS.

Each larva having fixed on a suitable location, spins for itself an oval, compressed, rather tough cocoon of fine silk, with particles of earth or other material adhering to the outside, which makes it extremely difficult to discover them. Within this enclosure the larva changes to a chrysalis, which is of a pale orange colour with brown eyes; on the front of the head are two short conical tubercles, and behind these two long bristles. The sheaths in which the antennæ are concealed are curved outward, much like the handles of an urn. The duration of the pupa state of the early brood is about ten days. When the fly is about to emerge, the chrysalis works its way out of the cocoon to the surface, and then opening the fly escapes.

THE FLY.

The perfect insect is a minute two-winged fly, about the size and general appearance of the common Wheat Midge. The head is black; the antennæ long, yellowish-red, with sixteen or seventeen joints in the female and fifteen in the male. Wings nearly transparent, clothed with many short curved blackish hairs, which give them a dusky appearance; each wing has three longitudinal veins, the third either forming a fork, or else becoming more or less obsolete towards the tip. Hairy fringe of wings, paler and composed of longer hairs than those on surface of wing. Abdomen fuscous, with black hairs above on each segment; thorax black, and clothed with rather long hairs. The male has an extended pair of clasping organs on the hinder extremity; the female a long pointed ovipositor, about twice the length of the abdomen.

Figure 13 represents the female fly with her four-pointed ovipositor extended; at *c* we have a more highly magnified view of the tip of the ovipositor, clothed at its extremity with short hairs. At *b* we have the head highly magnified, to show the structure of the eye, the four jointed palpi and the basal joints of the antennæ; at *d* we have a portion of one of the antennæ much enlarged. The small lines at the right give the natural size of the midge.

Figure 14 shows the male fly similarly enlarged, with highly magnified representations of the head at *b*, the peculiar clasping organs at *c*; the pedunculated joints of the antennæ at *c*, which are more rounded and hairy than those of the female. At *e* the claws at the tops of the legs are shown; and at *f*, forms of the scales which are distributed over the wings and body.

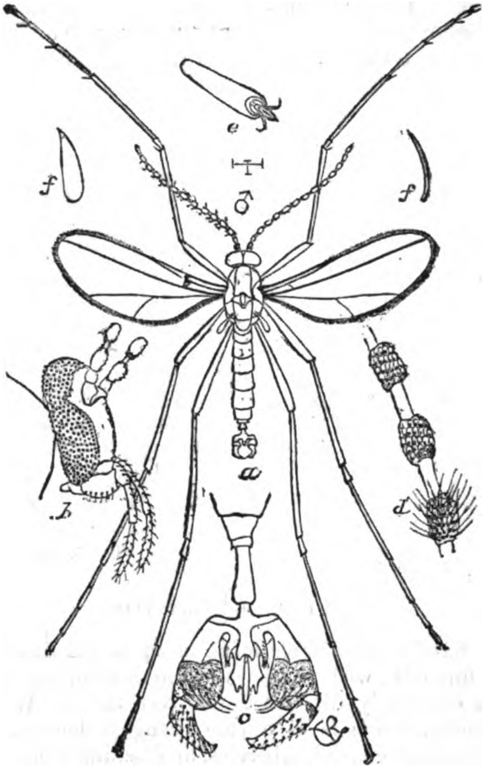

Fig. 14.

For the above figures, as also for those of 12, 15, 16 and 17, we are indebted to the kindness of Prof. J. A. Lintner, of Albany; 12, 13, 14 and 15 are from drawings made by Prof. C. V. Riley; 16 and 17 from drawings by Prof. J. H. Comstock.

Number of Broods.

There are certainly two and probably three broods in a season in the State of New York; flies of the first brood make their appearance in the latter part of May, and larvæ may be found full-grown in the clover heads early in July; during August the flies are again on the wing, and the next crop of larvæ are full-grown in September. In Washington three broods have been observed in the season; the full-grown larvæ of the first brood enter the ground by the 23rd of May, flies issuing from these early in June, which laid eggs from which larvæ matured, and flies again appeared in September. The flies of the later brood begin to issue in September, and continue to escape all through the mild autumn weather, and some remain in the chrysalis state until the following spring. From earth taken from the surface of an infested clover-field, and kept in a warm room the flies have been found to escape throughout the winter.

Localities Affected.

This troublesome pest is now very generally distributed over the State of New York, and has lately been observed in Vermont; it has also been found in the district of Columbia and across the river in Virginia, where the clover crops have suffered from this cause; it has also been found in Pennsylvania. Although not yet reported from the territory lying between the points mentioned, it is very probable that it has spread over the whole of it. In Ontario it has been found along the line of the Canada Southern Railway, also in the neighbourhood of Hamilton. At the Annual Meeting of the Entomological Society, held in London in September last, Mr. William Weld, editor of the *Farmer's Advocate*, stated that he had recently received clover heads from several correspondents infested with an insect which he believed to be this Clover Midge. Mr. Charles Arnold, of Paris, Ont., also thought, from what he had heard from those growing clover in his vicinity, that the insect was injuring the crop there, and promised to send some specimens to the writer on his return home if he could find them. On the 1st of October I received from Mr. Arnold a small box with some heads of red clover, in which I found a considerable number of full-grown larvæ of the Clover Midge, thus establishing the fact of its occurrence in that central district of Ontario. Mr. Arnold reports that the insect has done a considerable amount of injury in his locality.

A Source of Serious Danger.

I have lately received from Mr. L. T. Derousse, of Camden, New Jersey, the manuscript of a paper read by him before the Microscopical Society of Camden, in which he called attention to the fact of living specimens of this larva being found abundantly in clover seed offered for sale, and exhibited under the microscope specimens of the larva so obtained. He stated that these larvæ were found in a lot of clover seed which was sent to Wilson, Fitzgerald & Co., seed dealers, of Camden, N.J., from the upper part of Pennsylvania. These dealers, in the course of their examination of this clover seed by sifting, etc., with the view of ascertaining how far it was contaminated with foul seeds, were surprised to find a quantity of these larvæ distributed throughout the seed. Samples of the infested seed were at once sent to Prof. George H. Cook, Director of the New Jersey Experimental Station, who submitted them to Mr. A. S. Fuller, of Ridgewood, N.J., and he identified them as the larvæ of the Clover Midge. Subsequently specimens of the insect were sent to Prof. C. V. Riley, of Washington, Entomologist of the Department of Agriculture, and, although they were dead when they reached him, he had no difficulty in recognising them as specimens of this injurious insect. In view of these facts, it is of the utmost importance that farmers exercise the greatest caution in the purchase of clover seed, else, while sowing their seed, they may at the same time be sowing an enemy that will to a greater or less extent destroy the crop. Seedsmen also should exercise great care, otherwise they may be the means of seriously injuring the clover growers in their district by the introduction and dissemination of this pest.

Importance of the Study of Entomology.

The importance of the study of Entomology will, in this connection, be apparent to everyone, since it places the farmer on his guard against an enemy which may inflict on his crops untold damage, and such a word of caution may save the agricultural community many thousands of dollars. At a recent meeting of the Farmers' Club, of Onondago County, N.Y., Prof. Lintner made the following remarks:—"Occasionally at the present day we may hear insects and entomologists spoken of as 'bugs' and 'bug-hunters,' epithets applied in derision to what are regarded as petty objects and trivial pursuits. Such views only betray an ignorance which is equally pitiable and inexcusable. The study of insects has assumed an importance in its direct application to agriculture, horticulture and sylviculture, second to no other department of natural history. It has called to its aid some of the best intellect of the country, and its literature has become extensive and assumed a high rank. Our State governments, in response to demands made upon them, are appointing State entomologists; our general Government is making liberal appropriations for entomological work in the Department of Agriculture at Washington, and also for sustaining a special United States Entomological Commission, now in the third year of its operations, charged with the investigation of a few of our more injurious insects. The study of insects assumes an importance in this country greater than in any other part of the world. Nowhere else does Mother Earth yield in such variety and in such abundance her agricultural products; after supplying to repletion our own people, the excess is distributed to every quarter of the globe. Few of these varied products are native to our soil. Nearly all of our fruits, grasses, cereals and vegetables are of foreign importation, mainly from Europe. With their introduction many of the insects that preyed upon them were also introduced, or have been subsequently brought hither, but, unfortunately for us, the parasites which preyed upon them and kept them under control have for the most part been left behind. As the result, the imported pests in their new home find their favourite food-plants spread out in luxuriant growth over broad acres, where they may ply their destructive work without hindrance or molestation until some native parasites acquire the habit of preying upon them. Every crop cultivated on a large scale offers strong invitation to insect attack, and wonderfully stimulates insect multiplication."

How to Treat Infested Clover Seed.

Should any of our readers find themselves in possession of infested seed, the larvæ may be destroyed by heating the seed with constant agitation in a vessel freely exposed to the air for an hour or two, which will cause the grubs to dry up and perish. Seed may be heated in this way to a degree unpleasantly hot for the hand without injury. It has also been suggested to enclose the seed in tight barrels and pour some benzine on it. If the barrels were only partly full, and the seed agitated to disseminate the benzine throughout the mass, this remedy would probably be efficient in destroying the larvæ; but a little of this liquid poured on the top of a full barrel, being very light and volatile, would soon escape through the minute crevices of the barrel, and scarcely find its way to any extent through the compact mass of seed. Chloroform or bisulphide of carbon would perhaps answer a better purpose; their vapours, being heavier than the air, would penetrate downwards, while benzine, being much lighter than air, would escape upwards. Camphor has also been suggested, but it is not likely that this substance would produce any effect whatever.

Remedies.

Where this insect has become fairly established and is doing much damage, there seems to be but one method of subduing it, and that is, for the farmers in such a district to cease growing clover for a year or two, and thus in a measure starve the insect out. This plan, however, would not be likely to entirely eradicate the evil, since it is known that the insect sometimes attacks the white clover which grows everywhere as a weed. If farmers in infested districts would cut their clover earlier than usual, just as it is coming into bloom, and while the larvæ are young, most of them would perish; and this might be accomplished at the expense of but a slight reduction in the value of the hay crop, while the prospects for a crop of seed in the autumn would be comparatively good. The more generally this plan was adopted the better the results would be; indeed, united effort in this direction would be essential in order to accomplish much, and at the same time care should be taken to leave no clover uncut in fence corners or other out-of-the-way places.

Insect Parasites.

Small as this insect pest is, there are insects still smaller which are parasites on it. Two distinct species of these diminutive friends have been observed and their work recorded by J. H. Comstock, in the Report of the Commissioner of Agriculture at Washington. They are both very minute four-winged flies; one is very nearly related to the celebrated Joint Worm Fly (*Isosoma hordei*), and has received the name of the Funereal Eurytoma (*Eurytoma funebris*); the other is a species of *Platygaster*, known as *Platygaster error*, Fitch. The first feeds on the larva of the clover seed midge while it is in the clover seed capsule; undergoes all its transformations within the seed vessel, making its exit as a fly through an irregular hole gnawed through the side, just large enough to permit of its escape. This parasite is found emerging just about or shortly after the time when the crop of midge larvæ leave the clover heads to go into the ground. It has been found in abundance about Washington, where the first specimens were observed on the

3rd of May; from that date until the end of June they were very abundant, and from the careful examination of many seed-heads towards the end of that month it was estimated that, while five-sixths of the clover seed had been destroyed by the midges, four-fifths of the midges had been destroyed by this parasite. Thus through the good offices of this one species of parasite the prospective numbers of the next brood of midges were reduced to the extent of 80 per cent.

The second parasite, *P. error*, develops more slowly, and remains within the body of the midge larva until after it has escaped from the clover head, entered the ground, and spun its cocoon; then the full-grown parasite, having destroyed its host, eats its way through the cocoon and escapes. This has been found as yet only in specimens of the midge larva received from Yates County, New York State.

THE CLOVER ROOT-BORER—*Hylastes trifolii*, Muller.

This is another new pest—a small beetle about one-twelfth of an inch long, belonging to the family usually known as Bark-borers, *Scolytidæ*, from their habit of boring irregular channels through the inner bark of various trees. This species, however, is a root-borer. The beetle is of a reddish-brown colour, coarsely punctured on the body, not so coarsely punctured on the head and thorax, with the whole body more or less hairy. They usually reach maturity in October; and the beetles hibernate in the root and probably live upon the root. Early in spring they leave their hiding-places, and, after pairing, the female proceeds to deposit her eggs.

The insect in its various stages is represented in the accompanying figure, 15: *d* shows the beetle; *b*, the larva as found in the burrows; *c*, the pupa, which is usually found lodged in a cavity at the bottom of the burrow; the figures are about ten times their natural size. At *a a a*, the destructive work of the larvæ on the roots of the clover is shown.

How and Where the Egg is Deposited.

The female bores a large cavity in the crown of the root, and there deposits from four to six pale-whitish elliptical eggs, which hatch in about a week.

The Larva, or Grub.

The young larvæ at first feed in the cavity made by the parent until it is enlarged to the size of a small pea; then they begin to gnaw sideways and downwards, probably because the lower and more tender portions of the root are more suitable for their nourishment than the upper woody portions. The burrows run in a nearly straight line, and lie between the outer skin and the woody centre of the root, and are filled with black excremental dust. When full-grown the larva (*b*, fig. 15) is a little over one-eighth of an inch long, of a dingy white colour, with a pale yellow head and brown mandibles. Although the perfect beetle is believed to feed on the clover roots, it is in the larval condition that this insect is most destructive, working more particularly on the larger roots—in many instances entirely severing them at the surface of the ground—and this to such an extent that at times it is found extremely difficult to cut the clover, owing to the ease with which the plant is pulled up before the mower. Up to the time of frost Prof. Riley has found the insect in all stages of growth, but at this time the perfect beetles are most numerous.

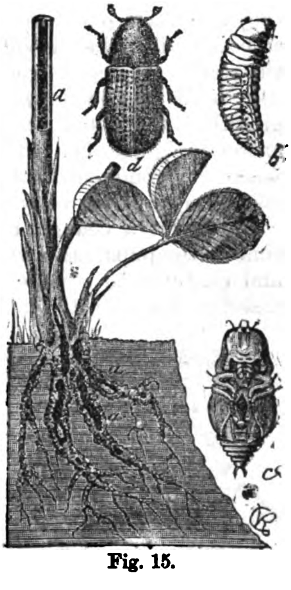

Fig. 15.

The Pupa, or Chrysalis.

The pupa (*c*, fig. 15) occupies a smooth cavity at the end of the gallery or chamber excavated by the larva. Here, at the end of September, it is to be found with its head upwards, and if the season is favourable most of the beetles escape in October.

LOCALITIES INFESTED.

This insect is found in Europe, from whence it has probably been brought to this country, but it is not very common there, and is not usually spoken of as a serious clover pest. In America, however, it has become quite formidable. It was first brought to the notice of Prof. Riley in the autumn of 1878, from specimens discovered in Yates County, N.Y., and has proved quite destructive there as well as in several other counties in that State. A correspondent in the *American Entomologist*, Vol. III., p. 227, writing in 1880, says: "It has taken all the clover in parts of Genessee County. In half a dozen clover fields examined within a ride of ten miles, every plant pulled up was found to be more or less injured by it." It is during the second year that injury to the clover plant by this insect is most observed.

REMEDIES.

No better remedy is yet known than to plough infested fields in the spring of the third year of the clover, at which time the insect is most abundant, and by general agreement throughout the more seriously infested districts to refrain from the culture of clover for two or three years. It is not as yet known that any special parasite is attacking this insect, but Mr. Riley on one occasion found the larva of a beetle, a species of *Telephorus*, preying on it. We have not yet heard of this pest occurring in Ontario, but we cannot expect to be long free from it if it continues to spread among our near neighbours.

THE CLOVER-STEM BORER—*Languria Mozardi.*

This insect infests the stem of the clover plant, burrowing in it, and either materially weakening it or killing it outright. It occurs throughout the greater portion of the United States, and is also found in Canada. It is, however, a rather rare insect, and one scarcely likely to prove very troublesome, on account of its rarity. It has been bred by Prof. Comstock, of the Department of Agriculture in Washington, who has carefully recorded its habits and changes in the several stages of its existence, and to him we are indebted for the following facts in its history:—

The eggs are laid in the stems of the clover, in holes gnawed by the parent insect; they are about one-sixteenth of an inch long (see fig. 16), of a yellowish colour, rounded at both ends and somewhat curved. They will usually be found imbedded in the pith of the stem. The egg is generally laid high up in the stem, and the young, slender, worm-like larvæ burrow downwards, consuming the central substance of the stem during their growth to the extent of from six to eight inches. The full-grown larva (shown at the extreme right in fig. 16) is more than three-tenths of an inch long, of a yellow colour, with six prominent thoracic legs and a prop-leg at the posterior end of the body. The last segment of the body has two stiff spines above, slightly curved upwards.

The larva changes to a chrysalis (see fig. 16) in the lower part of its burrow. The time of the pupal state varies much in its duration; the beetles begin to issue in August, and continue to emerge until late in October. There is probably but one brood of the insect in a season, the insect hibernating for the winter in the beetle state.

The beetle (fig. 16) is slender and cylindrical, with a yellowish-red thorax. The wing-covers are bluish-black with a green tinge, and are marked with deeply-impressed punctures arranged in regular rows. In fig. 16 the insect is represented in its various stages, together with the work of the larva within the stem. Prof. Comstock has found two species of parasites within the burrows of the stalk-borers—the one a small, black chalcid fly, the dark, naked pupa of which was often met with; and the other a yellowish ichneumon, the pupa of which was enclosed in a delicate white silken cocoon. Possibly

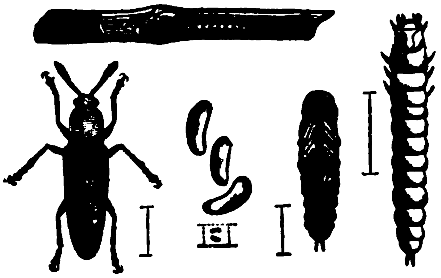

Fig. 16.

we are indebted to the unceasing vigilance of these tiny insect friends for the comparative rarity of this insect pest.

THE CLOVER-LEAF MIDGE—*Cecidomyia trifolii.*

This is a European insect which has been recently discovered in this country. It has been studied at the Department of Agriculture in Washington, and reported on by Prof. Comstock. Although we are not aware of its occurrence as yet in Canada, we submit a brief sketch of its history condensed from the report of the entomologist at Washington.

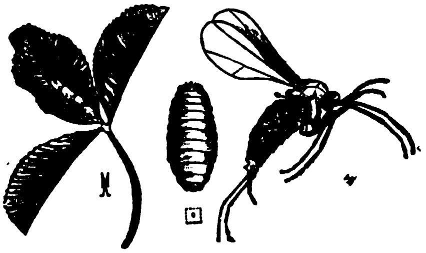
Fig. 17.

It attacks the leaf of the clover, and in fig. 17 we have represented the folded leaves containing the larvæ, a partially-opened leaf-case showing the cocoons attached to the leaf, and the larva and female midge both enlarged.

The fly so closely resembles the clover seed midge that it can scarcely be distinguished from it excepting by critical examination; it is a little smaller in size, and the female has two joints less in her antennæ. It attacks both the red and white clover.

About the middle of June is the time when the larva is found; it folds the leaflets together upon the mid-rib so that the two edges almost coincide. The under side of the folded leaves turn yellow or brownish, and upon opening them they are found to contain from one to twenty whitish or pale orange-coloured larvæ, much like those of the clover seed midge, but somewhat smaller and paler in colour, with the whole surface of the body coarsely granulated. Within the folds the larvæ change to chrysalids, enclosed in delicate white oval cocoons fastened to the sides of the leaf. The enclosed chrysalis is of a pale orange colour, with a median ventral stripe of a darker shade.

This insect is not yet reported as occurring in any other locality than Washington; should it much extend its operations and become generally common, or even abundant, it is not likely, from the nature of the injury it causes, ever to become a serious injury to the clover crop. It has never been known to injure clover to any serious extent in Europe.

THE CLOVER HAY WORM—*Asopia costalis.*

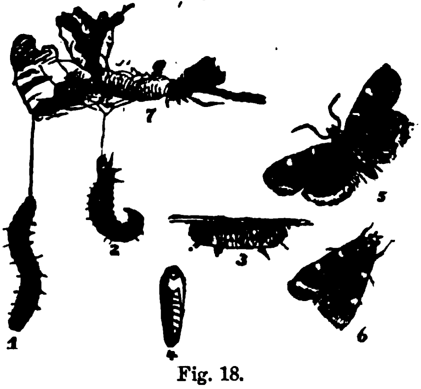

Fig. 18.

This pretty little moth, which is represented of natural size in fig. 18 at No. 5, with its wings expanded (No. 6 wings closed), is frequently seen during the summer months, often finding its way into our dwellings. It is not active during the middle of the day unless in very dull and cloudy weather, but towards evening it is on the wing, and then may often be met with in numbers, flitting around in the neighbourhood of clover stacks. When its wings are spread it measures about eight-tenths of an inch across. The fore wings are of a reddish or purplish-brown hue, with a greyish tint over all and a silky gloss. Along the front margin there are two large, bright golden-yellow spots, dividing each wing into three nearly equal parts; the outer spot is the larger of the two, and from each there extends a lilac-coloured line back to the hind margin; the hind-wings are lighter in colour, with two pale, wavy, transverse lines; both wings margined with deep orange and fringed with golden-yellow; under surface paler, with the markings less distinct. In fig. 18 the larva is shown at 1 and 2, at 7 the same enclosed in its silken web, the cocoon at 3, the chrysalis at 4, and the perfect insect at 5 and 6.

THE EGG.

The eggs are fastened to such clover as the females can find access to by creeping into the crevices and small openings in the stack. In a few days during the summer the larva is hatched.

THE LARVA.

The full-grown larva measures nearly three-quarters of an inch in length, tapering each way, with the body much wrinkled, and is of a dark, olivaceous-brown colour, with several smooth, shining dots on each segment, each giving rise to a fine, whitish hair. The young larvæ are paler in colour, and occasionally specimens will be found which, even at maturity, retain this lighter colour. They usually dwell within a cylinder of silk of their own constructing, and from this issue to feed on the dry clover. They are very active in their movements, wriggling briskly backwards as well as forwards, and are often found lively late in the season, with the thermometer down to the freezing point. Each larva has the power of readily spinning a silken thread, by means of which it suspends itself in mid-air, and where these larvæ are abundant in a barn, they sometimes hang in this way in such numbers from the timbers of the building as to be a source of great annoyance to passers-by.

THE PUPA.

When full-grown, the larva seeks some sheltered spot in which to pass the chrysalis state of its existence, and often selects the under side of a piece of board or other sheltering substance for this purpose, and there constructs an oblong oval cocoon of silk intermixed with particles of excrement and other foreign matter, and in this passes the next stage of its existence. The chrysalis is about one-third of an inch long, and of a pale yellow colour, with markings of a deeper shade.

NUMBER OF BROODS.

There are doubtless two or more broods of this insect each year.

PAST HISTORY AND MODE OF OPERATION.

This insect is one which is widely distributed. It is common in Europe, from whence it has probably been brought to this country. In Europe, however, it does not appear to have ever attracted attention as an insect injurious to clover. In this country its destructive habits have long been known and often commented on. It is abundant throughout the Eastern, Middle, and some of the Western States, as well as in Canada. It is in the larval state only that the insect is injurious. The larva does not feed on clover in its green or growing condition, but infests it in the stack or barn, and spoils it for feeding purposes by devouring its substance, interweaving it, and covering it with white silken webs and black excrement resembling grains of gunpowder. Sometimes the silken webbing is so dense as to make the hay look mouldy. It is towards the bottom of a stack that the injury is chiefly done ; instances are on record where two feet or more of the lower portion has been so full of worms and cocoons as to be rendered worthless.

REMEDIES.

As the worms feed only on dry clover, they must be confined during the summer to those portions of clover hay remaining over from the previous year's making; on this account new hay should not be stacked with the old. Where clover is stacked for several years on the same foundation, the bottom layers, coming in contact with the infested leavings of the previous year, will be sure to suffer. It is also recommended to put a good log or rail foundation under the stack, so as to raise it above the surface.

THE CLOVER DRASTERIA—*Drasteria erechtea.*

This is a very common clover insect, very generally distributed, but never, as far as we know, yet reported anywhere as doing much injury to the crop. The moth is well represented in fig. 19. The moth, when its wings are expanded, will measure from an inch and a quarter to an inch and a half across. The fore wings are greyish-brown, with bands and dots of dark brown—one band crossing the wing about an eighth of an inch from the base; a second, which does not always extend entirely across, is placed midway between the first and the outer margin. There is a dull patch of brown near the front edge of the wing, between the first and second bands, and two or three prominent black dots similarly situated between the second band and the apex; the outer edge is also widely margined with brown.

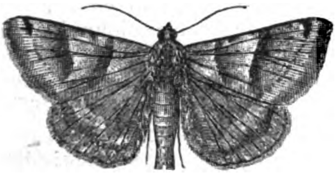

Fig. 19.

The inner portion of the hind wings is of a similar colour to the front pair, the outer half being crossed by two darker bands irregular in outline, the space between them paler, as also is the space between the outside band and the hind margin. The markings on both wings vary much in intensity, being sometimes almost black, in other instances very pale. The under surfaces of both wings are much paler than the upper, with the markings of the upper side partially, but indistinctly, produced.

This insect passes the winter in the chrysalis state, and is among the earliest on the wing in spring; it is also found up to a late period in the autumn. It frequents fields, meadows, and other open grassy spots. Its flight is sudden, and after a short but rapid course it as suddenly alights.

It is in the caterpillar state that this insect feeds on clover. When full grown it measures an inch and a quarter or more. It has a medium-sized head of a reddish-brown colour, with darker longitudinal lines. The body is reddish-brown above, with many longitudinal lines, and stripes of a darker shade. There is a double whitish line down the back, with a stripe of the darker shade of brown on each side, and lower down close to the spiracles is another stripe of the same dark hue, while between these two are faint longitudinal lines. The spaces between the segments, from the fifth to the eighth inclusive, are nearly black above, a feature only seen, however, when the larva is coiled up, a position it readily assumes when disturbed. The under surface is a little darker than the upper, with many longitudinal lines of a still deeper shade, and a central stripe of blackish green from the sixth to the ninth segments. Having but three pairs of pro-legs, it alternately arches and extends its body in progression.

THE CLOUDED SULPHUR BUTTERFLY—*Colias philodice.*

The common Yellow, or Clouded Sulphur Butterfly, is found almost everywhere in its season—in fields and on roadways, often congregating in groups on the borders of streams and muddy pools, where they seem to enjoy settling on the cool moist ground.

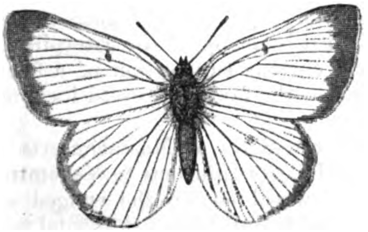

Fig. 20.

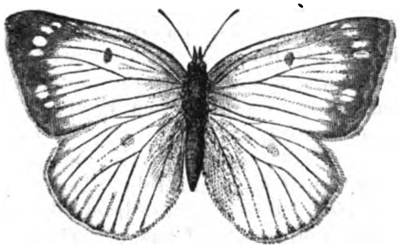

Fig. 21.

As the summer progresses, they are usually very abundant in clover fields. Figure 20 represents the male of this butterfly; fig. 21, the female—it will be seen that the sexes differ somewhat in their markings. The ground colour of the wings in both is bright yellow, with a dark brown or blackish border, which is narrow in the male but wide in the female, and enclosing in the latter a broken row of irregular yellow spots. There is also a spot of black placed near the front edge of the fore wings, about half-way between the base and the tip, varying in form and distinctness. The hind wings in both sexes are about equally dark margined, and near the middle is a dull pale orange-coloured spot. Both wings are dusky towards the base, and the fringes are pink. The antennæ are pink, with the knobs at their tips darker. The body above of a dark colour, paler at the sides and underneath.

On the under side the yellow colour is less bright, while the dark margins are either entirely wanting or represented by faint dusky shadings. The spot on the fore-wings is distinct, but paler and usually centered with a small silvery eye; that on the hind-wings is much more distinct than above, being composed of a bright silvery spot in the centre defined by a dark brown line, which is in turn encircled with dull orange. The butterfly first appears on the wing about the middle of May, but the time of its greatest abundance is during the latter part of July and throughout August.

The eggs are deposited on clover, and also on the cultivated pea and blue lupin; they are long, tapering at each end, and ribbed; of a pale lemon-yellow colour, which changes in three or four days to a pale red, then gradually to a bright red, and from that to dark brown just before hatching. The young caterpillar is of a dull yellowish-brown colour, becoming dark green as it grows older. When full grown it is about an inch long, with a dark green head and body of the same colour; the latter with a yellowish-white stripe on each side close to the under surface, with an irregular streak of bright red running through its lower portion. The body is thickly clothed with very minute hairs, giving it a downy appearance.

The chrysalis is about seven-tenths of an inch long, attached at its extremity to a mass of silken fibres spun by the caterpillar, and girt across the middle with a silken thread. Its colour is pale green with a yellowish tinge, with a purplish-red line on each side of the head, darker lines down the middle both in front and behind, and with a yellowish stripe along the sides of the hinder segments. During the warmer summer weather the chrysalis state usually lasts about ten days; a day or two before the butterfly escapes the chrysalis becomes darker and semi-transparent, the markings on the future wings showing distinctly through the enclosing membrane.

This, like the insect last described, although always common, has never yet been known to seriously injure the clover crop. There are also a number of other species which feed on clover, but as they are none of them especially injurious, it is not necessary to refer to them at present.

SPHINGIDÆ—HAWK MOTHS.

BY EDMUND BAYNES-REED, LONDON, ONT.

This family comprises some of the largest, most robust and powerful of the moths. From the strength and swiftness of their flight, they have acquired their English name of Hawk Moths. The peculiar attitude which is assumed by many of the caterpillars of the various species of these moths, gave rise to the curious supposition of a fancied resemblance to the famous Egyptian Sphinx, and hence the family received its generic name of Sphingidæ.

Dr. Thaddeus Harris, the veteran Entomologist of the State of Massachusetts, and the author of an admirable "Treatise on Some of the Insects Injurious to Vegetation," thus vividly portrays these lively denizens of the insect world:—"In the winged state the true Sphinges are known by the name of Humming-bird Moths from the sound which they make in flying, and Hawk Moths from their habit of hovering in the air while taking their food. These humming-bird or hawk moths may be seen during the morning and evening twilight flying with great swiftness from flower to flower. Their wings are long, narrow and pointed, and are moved by powerful muscles. Their tongues, when uncoiled, are for the most part excessively long, and with them they extract the honey from the blossoms of the honeysuckle and other tubular flowers while on the wing. Other Sphinges fly during the day-time only, and in the brightest sunshine. Then it is that our large clear-winged Sesiæ make their appearance among the flowers and regale themselves with their sweets. The fragrant Phlox is their especial favourite. From their size and form and fan-like tails, from their brilliant colours and the manner in which they take their food, poised upon rapidly-vibrating wings above the blossoms, they might readily be mistaken for humming-birds."

The perfect insect lays its eggs singly on the leaves of the food plants of the larvæ, or caterpillars. These, when full grown, are generally of a large size; their colours are often bright, and in the several species there is a great variety and difference of ornamentation. They have eight pairs of feet, and on the back of the last segment but one there is generally a rigid spine, called the caudal horn, and in those species, where this horn is wanting, its place is taken by a tubercle. Their bodies are cylindrical, smooth and naked, and in some species are remarkable for the faculty they possess of contracting and elongating the first three segments of the body. Reference has already been made to the peculiar sphinx-like position assumed by some species of these caterpillars when at rest. Although these larvæ lead a solitary life, and do not live and move about in large numbers like the processionary caterpillars of the army worm and lackey moths, yet, from their large size, they are often capable of doing considerable injury to shrubs and plants. The number of species known is said to be between 300 and 400, most of which, however, inhabit tropical America; and as some 32 of these are known to inhabit our Province of Ontario, we have thought it desirable to give an account of each, which, we trust, may be found useful and interesting. In doing this, we have gladly availed ourselves of the various authorities on this family of moths, especially acknowledging the comprehensive monograph of the late talented Entomologist, Dr. Brakenbridge Clemens, of Easton, Pennsylvania, and the synonymical catalogues of North American Sphingidæ published by Messrs. A. R. Grote and the late Coleman T. Robinson, and finally revised and completed by Mr. Grote. To this last-named gentleman our Society is indebted for the proper determination of a good many of the Sphingidæ in the collection of our Entomological Society of Ontario. Reference, moreover, must not be omitted to the labours of Mr. J. A. Lintner, the State Entomologist of New York, who has done much by the publication of his observations to promote a knowledge of the habits and life history of many of the larvæ of our Sphingidæ.

CATALOGUE OF ONTARIO SPHINGIDÆ.

Genus HEMARIS, *Dalman.*

1. Diffinis, *Boisduval.*
2. Tenuis, *Grote.*
3. Marginalis, *Grote.*

Genus HÆMORRHAGIA, *Grote* and *Robinson.*

4. Uniformis, *Grote.*
5. Thysbe, *Fabricius.*

Genus LEPISESIA, *Grote.*

6. Flavofasciata, *Barnston.*

Genus AMPHION, *Hubner.*

7. Nessus, *Cramer.*

Genus THYREUS, *Swainson.*

8. Abbotii, *Swainson.*

Genus DEILEPHILA, *Ochsenheimer.*

9. Chamænerii, *Harris.*
10. Lineata, *Fabricius.*

Genus CHŒROCAMPA, *Duponchel.*

11. Tersa, *Linnæus.*

Genus DARAPSA, *Walker.*

12. Chœrilus, *Cramer.*
13. Versicolor, *Harris.*
14. Myron, *Cramer.*

Genus PHILAMPELUS, *Harris.*

15. Pandorus, *Hubner.*
16. Achemon, *Drury.*

Genus PAONIAS, *Hubner.*

17. Myops, *Abbot* and *Smith.*
18. Excæcatus, *Abbot* and *Smith.*

Genus SMERINTHUS, *Latreille.*

19. Geminatus, *Say.*

Genus CRESSONIA, *Grote* and *Robinson.*

20. Juglandis, *Abbot* and *Smith.*

Genus AMORPHA, *Hubner.*

21. Modesta, *Harris.*

Genus CERATOMIA, *Harris.*

22. Amyntor, *Hubner.*

Genus DAREMMA, *Walker.*

23. Undulosa, *Walker.*

Genus SPHINX, *Linnæus.*

24. Quinquemaculata, *Haworth.*
25. Chersis, *Hubner.*
26. Drupiferarum, *Abbot* and *Smith.*
27. Kalmiæ, *Abbot* and *Smith.*
28. Gordius, *Cramer.*
29. Eremitus, *Hubner.*
30. Luscitiosa, *Clemens.*

Genus DOLBA, *Walker.*

31. Hylæus, *Drury.*

Genus ELLEMA, *Clemens.*

32. Harrisii, *Clemens.*

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1. HEMARIS DIFFINIS, Boisduval.

Sphinx fuciformis, Smith, Ab. and Sm., Ins. Ga, Vol. I., p. 85.
Macroglossa diffinis, Boisduval, Sp. Gen., Plate 15, fig. 2.
Sesia diffinis, Walker, C. B. M. Lep., Part VIII., p. 81.
Sesia diffinis, Morris, Syn. N. A. Lep., Sm. Ins., p. 148.
Sesia diffinis, Harris, Ins. Inj. Veg., p. 328.
Sesia diffinis, Clemens, Syn. N. A. Sph.
Hemaris diffinis, Grote, 1875.

Mature Larva.—Bright blue above, with the sides pale green; the under part dark reddish colour; a dark green dorsal line; a pale yellow stripe on each side. On the first segment is a transverse gold ridge, and a row of black dots on each side; the head palish blue; length, one inch and a half; caudal horn black and sharp-pointed. Feeds on the bush honeysuckle (*Diervilla trifida*) and fever wort (*Triosteum perfoliatum*), found about June and the beginning of July; spins cocoons on the ground from the leaves of their food plants, and the moths appear about a month later. The moth has the head and thorax pale yellowish-green; the breast pale yellow, with blackish hairs beneath the legs, and all the legs black; the upper part of the body has the same pale yellowish hue, inclining to black towards the extremity, which is tufted with a blackish fringe; the under side of the body is bluish-black, with pale yellow patches. The wings are transparent in the middle (from this fact these moths are known as bee-moths or clear-wings); in the fore-wings there is a narrow, dark-brownish border, the inner edge of which is *very slightly rounded and evenly scalloped on the interspaces;* the apex of the fore-wings has a red stain on the marginal band; the hind-wings are bordered with dark brown near the base, broadly on the inner margin. The colour of this species varies considerably, a warm, reddish tint being very frequently observed. Expanse 1.75 to 1.80 inch; length of body, about an inch; very common; the larvæ often stripping entirely bare the leaves of the bush honeysuckle.

Mr. Grote thus describes his definition of the species: "The species for which I use the name Hemaris are black and yellow-bodied, more or less fuzzy; they look like Humble-bees."

2. HEMARIS TENUIS, Grote.

The larva is, we believe, at present unknown. The species is one of Mr. Grote's determination, and very similar to *diffinis.* The moth is pale yellowish and black—the tuft at the extremity black, divided by yellow central hairs; legs black; breast pale yellowish-white; wings largely vitreous (clear), with very narrow, dull blackish borders; blackish at base, as usual, and partially overlaid with yellowish scales; costal edging narrow; the band *along the external margin is even on its inner edge and narrower throughout* than in any species hitherto described from the Atlantic District. There is no perceptible red apical shading. The body squamation (or scaling) is rather rough, and in size it is the *smallest* of our species yet described. The external margins of the wings are more rounded and full than in any of our other known species of Hemaris. Expanse 1.50 inch; length of body .80 inch.

3. HEMARIS MARGINALIS, Grote.

The moth has the upper side of the thorax of a yellowish olive-coloured shading, the scaling becoming deep yellowish over the basal abdominal segments dorsally; middle segments black—the two last deep yellowish. The anal tuft black, with central yellowish hairs; the abdomen black; legs black; the thorax underneath is sulphur white. The body seems narrower, more fusiform, than in the other species, and the scales more depressed. Wings largely vitreous, ornamented as usual, but with a wider terminal band on the front wings than is seen in *H. diffinis*. *The inner edge of this marginal band is plainly dentate or toothed inwardly on the upper spaces.* There is a reddish apical stain as in *diffinis*. Expanse 1.65 to 1.70 inch; length of body .95 inch.

Mr. Grote thus separates these three northern species of Hemaris:—

Terminal band of front wings even on its inner edge—*tenuis*.
" " interspaceally roundedly exserted on its inner edge—*diffinis*.
" " insterspaceally dentate on its inner edge—*marginalis*.

4. HÆMORRHAGIA UNIFORMIS, Grote and Robinson.

Sesia ruficaudis, Walker, C. B. M. Lep., p. 82, Part VIII.

"On the other hand, the species of Hæmorrhagia are Indian red and olive, with flattened body hairs, and by their form prepare us for the still more compressedly-shaped species of the genus Ællopos." (*Grote.*)

Moth.—"Fawn colour; head whitish about the antennæ and beneath, with a brown band in front; the breast testaceous; abdomen deep red fawn colour at the base, with testaceous spots along each side; hind borders of segments black; apical tuft red, with some black hairs on each side; wings limpid deep red at the base, and with broad deep red borders; fore-wings deep red at the tips and with a blackish discal streak. Length of the body, 9-12 lines: of the wings, 18-24 lines." (*Walker's description.*)

5. HÆMORRHAGIA THYSBE, Fabricius.

Sphinx Thysbe, Fabricius.
Sphinx Pelasgus, Cramer.
Sesia Thysbe, Fabricius.
Sesia Cimbiciformis, Stephens, Ill. Brit. Ent. Haust., Vol. I., p. 135.
Sesia Thysbe, Walker, C. B. M. Lep., Part VIII., p. 82.
Sesia Thysbe, Clemens, Syn. N. A. Sph.
Sesia Thysbe, Morris, Syn. N. A. Lep., Sm. Ins., p. 149.
Sesia Pelasgus, Harris, Ins. Inj. Veg., p. 328.
Hæmorrhagia Thysbe, Grote and Robinson, 1865.

Mature Larva.—The body tapers towards the front and is of a light yellowish-green colour, deepening on the sides; the body studded with green and yellow granulations; underneath the colour is dull rose, bordered by a buff stripe; a reddish stripe on the upper side of the body and white yellowish-green stripes on the side; the stigmata are red, with a white dot at each extremity; head granulated, dull green; when at rest partially buried beneath the first segment; caudal horn two inches long, curved, light blue, tipped with yellow and with black and white granulations; legs black, prolegs green; found in August and September; feeds on the snowball (*Viburnum Opulus*), the snow berry (*Symphoricarpus*) and hawthorn (*Cratægus*). Before going into the chrysalis state, it undergoes a marked change of colour, inclining to purplish-red and ochre-yellow. The cocoon is formed of a few leaves drawn together by a very slight spinning.

The moth has the thorax deep olive-green, mixed with brown; the breast and legs of a light cream or yellowish-white hue; the under surface of the abdomen is bright ferruginous (rusty red), with three or four small yellowish tufts between the segments on the line separating the dorsal and ventral segments; the lateral anal tufts are black, the central reddish-brown and ferruginous beneath; the front wings are ferruginous and olivaceous towards the base; the disk is divided by a dark brown line: the broad terminal band is dark brown, with a ferruginous patch in the apical insterspace; the hind wings have a bright ferruginous broad inner border, a moderately broad duller terminal band, the nervules in which are blackish. The moth appears about the same time as *H. diffinis*; it is often seen in the hot sun, and at twilight flying about the blossoms of the garden phlox, the common lilac, and *Rhodora Canadensis.*

6. LEPISESIA FLAVOFASCIATA, Barnston.

Macroglossa	*flavofasciata,*	Barnston, Walker, C. B. M.
"	"	Clemens, Syn, N. A. Sph.
"	"	Morris, Syn. N. A. Lep., Sm. Ins., p. 151.
Lepisesia	"	Grote, 1865.

We give Mr. Grote's description of this moth:—

"The peculiarly neat and elegant little species, of which this genus is composed, has not been very clearly described by Mr. Walker, and we give here its more detailed description, as follows:—Black. Above the thorax and head are clothed with pale yellowish sericeous (silky), erect hair, mingled with blackish scales; laterally the palpi and the orbits of the eyes are deep black; abdomen black, with sericeous hairs above on the basal segment; anal tuft black, with lateral sericeous sub-tufts; the anterior (front) wings are blackish, with obsolete (indistinct) ornamentation; a rather broad semi-diaphanous (transparent) sub-terminal band, composed of sparse and whitish scales, extends evenly and obliquely from costa to internal margin; the terminal portion of the wing is less thickly covered with scales, acquiring a paler tinge than the basal portion; posterior (hind) wings, with a broad central fulvous fascia (tawny stripe), which contracts triangularly towards internal margin, before anal angle becoming somewhat linear and sinuate (scooped out). Beneath, the anterior wings at base are largely covered with bright fulvous squamation (scales); the central fascia on posterior wings is whitish; legs and under thoracic and abdominal regions black. Expands—male, 1.60 inch; length of body, .80 inch."

7. AMPHION NESSUS, Hubner.

Sphinx Nessus, Cramer.
Sphinx Nessus, Fabricius.
Thyreus Nessus, Walker, C. B. M. Lep., Part VIII., p. 99.
Thyreus Nessus, Clemens, Syn. N. A. Sph.
Thyreus Nessus, Morris, Syn. N. A. Lep., Sm. Ins., p. 157.

The following description by Mr. W. V. Andrews appeared in Vol. IX. of *Canadian Entomologist*, p. 19:—

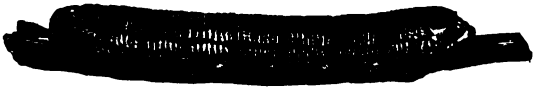
"*Mature larva,* two and a half to three inches in length, tapering gently from the fourth segment to the head; colour, uniform chocolate brown, thickly dotted over the body, and particularly along the dorsal line, with dark umber, of which colour are also the right lateral or stigmatal stripes; anal horn on eleventh segment very short, one-fifth of an inch in length; very sluggish in its movements, showing none of the irritability of *T. Abbotii* when touched. When at rest it stretches itself at full length along the leaf or leaf stem of the plant on which it feeds, never raising or retracting the anterior segments. *Pupa* dark brown; found either among rubbish on the surface of the ground or slightly beneath the surface; tongue case internal, not visible; feeds on fuchsia. Pupa 11th, 12th, 13th July, one moth on 8th August, two others not yet emerged, and probably will winter in the pupa state."

Moth.—Head and thorax dull ferruginous brown; breast somewhat reddish; a yellowish-white streak on the sides of the head and thorax; the abdomen a dark chestnut-brown, with the hind margins of third and fourth segments pale yellow; three or four bright ferruginous spots on the sides; the triple anal tuft deep chestnut; the under part of the body somewhat reddish, with three white dots on the last part of the hind segments; the fore wings brown, with a purplish hue; a dark chestnut broad middle band containing a lighter coloured discal spot; dark chestnut, ferruginous, and dark brown patches; the fringes dark brown in the middle, pale yellow in the excavations and bordered by dark brown; hind-wings bright red, with a dark brown terminal band; fringes from the tip to the centre brownish, and thence to the anal angle pale yellow; flies generally at twilight, and may be seen hovering over lilac blossoms. In the *Canadian Entomologist* of August, 1874, Mr. F. C. Lowe, of Dunnville, reported that this moth was common in clover fields.

The Rev. C. J. S. Bethune, the former editor of the *Canadian Entomologist*, in the month of June, 1868, in the middle of a very hot day, observed a beautiful specimen of this moth feasting on the carcase of a dog which was floating in a filthy pool.

8. THYREUS ABBOTII, Swainson.

Thyreus Abbotii, Walker. C. B. M. Lep., Part VIII., page 99.
" " Clemens. Syn. N. A., Sph.
" " Morris. Syn. N. A. Lep., Sm., Ins. page 156.



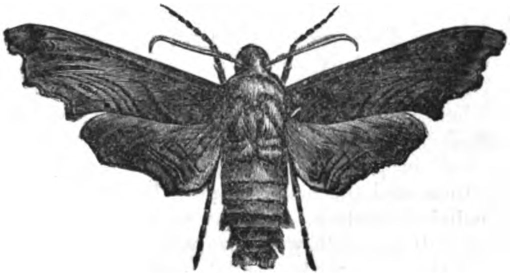


Fig. 22.

As has been pointed out by Mr. Lintner, the larva of *Thyreus Abbotii* is exceedingly interesting from the fact that its two styles of ornamentation, in marked contrast one with another, indicate the sex of the insect; being the only instance of the kind known among the butterflies and moths.

It will be noticed that the caudal horn is wanting, but its place is occupied by a polished tubercle. The larva does not assume the usual peculiar semi-erect attitude of the sphinges, but rests stretched at length, though when disturbed it shortens the front segments and throws the head from side to side, making at the same time a crepitating noise. Dr. Clemens states that when on the ground its motions under irritation are often violent. The characteristic marking of the head in both sexes distinguishes it easily, according to Mr. Riley, from its allies, being slightly roughened and dark, and a central mark down the middle often assuming the shape of an X; there being also a light broad band on each side.

The *male* larva is reddish-brown body, with numerous patches of light green, sometimes yellow, and on the sides a chocolate-coloured line. The tubercle is black, encircled by a yellowish line; the anal shield is pale green and brown.

Female larva has uniform reddish-brown body without any patches, so conspicuous in the male, but with broken subdorsal lines, and numerous transverse striæ.

The larva feeds on the various kinds of grape vines, and on the Virginia Creeper—*Ampelopsis quinquefolia.* When full-grown it measures about three inches in length.

The larva enters the pupa state about the end of July, the moth appearing the following spring.

As a general rule, the larva undergoes the transformation into the pupa state in a superficial cell on or near the surface of the ground, although instances are recorded of its burying itself altogether, as is the case with many other sphinges.

The moth, of which there is but one annual brood, is described by Riley as being of a dull chocolate or greyish-brown colour, the front-wings becoming lighter beyond the middle, and being variegated with dark-brown, as in the figure; the hind-wings are sulphur-yellow, with a broad dark-brown border, breaking into a series of short lines on a flesh-coloured ground near the body. The wings are deeply scolloped, especially the front ones, and the body is furnished with lateral tufts. When at rest, the abdomen is curiously curved up in the air.

This insect is tolerably common, especially in the neighbourhood of Hamilton.

9. DEILEPHILA CHAMÆNERII, Harris.

Deilephila Galii, Walker, C. B. M., Lep. Part VIII., page 166.
" " Clemens, Syn. N. A. Sph.
" *Chamænerii*, Morris, Syn. N. A. Lep., Sm. Ins., page 165.
" " Harris, Ins. Inj. Veg., page 328.
" " Grote, 1865.

The following description of the larva, by Mr. Wm. Saunders, is taken from the April number of the *Canadian Entomologist* for 1877, and was made from three examples found feeding on grape leaves, 5th July:

"Length two and a half inches, tapering towards each end; head small, rather flat in front, slightly bilobed, and of a dull pinkish colour, with a black stripe across the front at the base; basal half of palpi yellow, upper half black; mandibles black, with a patch of yellow between them and the black stripe. Body, above, deep olive green, with a brownish tinge and a polished surface. Second segment with a cervical shield similar in colour to head, its sides dull greenish with two yellow dots. There is a pale yellowish dorsal line terminating at the base of the caudal horn; each segment from 3rd to 12th inclusive has a pale yellow spot on each side of the dorsal line, about half way towards the stigmata thereon; 3rd segment small and almost crescent-shaped; on the 4th, larger and nearly round; 5th still larger, nearly round; 6th, 7th, 8th, 9th, 10th and 11th, about equal in size, nearly oval, and larger than those on 5th. On 12th segment the spot is more elongated, and, extending upwards, terminates at the base of the caudal horn. There is a wide but indistinct blackish band across the anterior part of each segment, in which the yellow spots are set; the sides of the body below the spots are thickly sprinkled with minute raised yellow dots. Caudal horn long, curved backwards, red slightly tipped with black, and with a roughened surface; terminal segment dull pinkish; stigmata oval, yellow, shaded round with dull black. Under surface much paler, colour dull pinkish-green, the pink colour predominating from 5th to terminal segments inclusive, and with a number of very minute raised yellowish dots placed chiefly along the sides. Feet black; prolegs pink, with a patch of black on the outside of each. One specimen spun a light web, binding a portion of the leaf, within which it changed to chrysalis on the 10th of July, and from this the moth appeared on the 28th of the same month. The other two larvæ died before completing their transformation."

The larva feeds on the grape-vine, and the great willow herb *Epilobium angustifolium*, and on purslane.

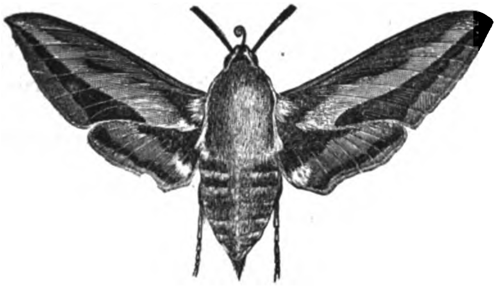


Fig. 23.

The moth, which flies about twilight, has the head and thorax olive-brown, with a white line on the sides. The abdomen is greenish-olive inclining to a reddish hue on the sides, and with black and white patches. The fore-wings are deep greenish-olive, with a buff-coloured band extending almost the whole length to the tip; on the outer margin another broad band or stripe of a dull ashy colour. The hind wings small and black, with a rose-coloured broad central band deepening towards the body, and having there a white spot; the hinder margin fringed with white. The moth expands about two and three-quarter inches.

10. **Deilephila lineata**, Fabricius.

Sphinx lineata, Fabricius.
" *daucus*, Cramer.
" *lineata*, Smith & Abbot, Ins. Ga.
" " Donovan.
Deilephila daucus, Stephens.
" " Walker, C. B. M. Lep., Part VIII., page 171.
" *lineata*, Clemens, Syn. N. A., Sph.
" " Morris, Syn. N. A., Lep. Sm. Ins., page 164.
" " Harris, Ins. Inj. Veg., page 328.
" " Grote, 1865.

Mr. Riley's description is given of this larva, which seems to vary exceedingly:

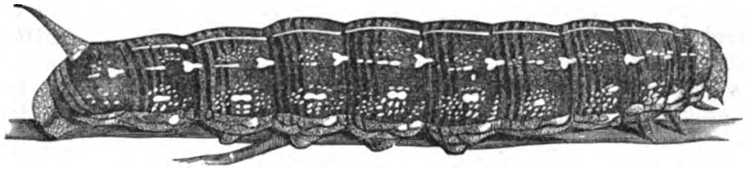


Fig. 24.

"The most common form is given at figure 24. Its colour is yellowish-green, with a prominent subdorsal row of elliptical spots, each spot consisting of two curved black lines, enclosing superiorly a bright crimson space, and inferiorly a pale yellow line—the whole row of spots connected by a pale yellow stripe edged above with black. In some specimens these eye-like spots are disconnected, and the space between the black crescents is of a uniform cream colour. The breathing holes are either surrounded with black or with black edged with yellow. The other form is black, and characterized chiefly by a yellow line along the back, and a series of pale yellow spots, and darker yellow dots as

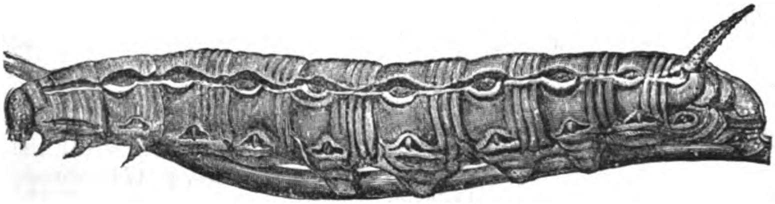


Fig. 25.

represented in figure 25. Even this dark form is subject to great variation, some specimens entirely lacking the line along the back, and having the spots of different shape."

The body tapers as in *D. Chamænerii.* The larvæ of this genus, when disturbed, fall from their food plants, shorten the anterior segments, and bend the head inwards. Length when full-grown is about three inches; the caudal-horn is rough, and yellowish-orange towards extremity. It is rather a general feeder, being found on the common purslane—*Portulacca oleracea*—turnip, buckwheat, apple, grape and watermelon.

The larval transformation is made in a superficial cell excavated from the surface, where it changes into a light brown chrysalis from which the moth appears in September.

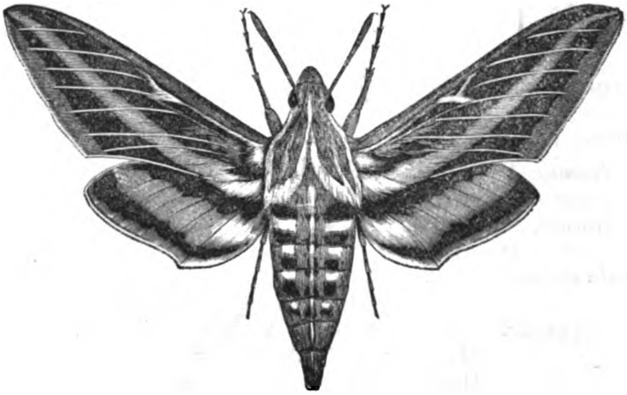


Fig. 26.

This moth (figure 26) is known as the white-lined morning sphinx. It is very common, and has a wide range, being found in all parts of the United States, Mexico and the West Indies, as well as in Canada. Of the two species of *Deilephila*, *lineata* is more common in this Province, and *Chamænerii* in Quebec.

It flies generally at twilight, although it may be occasionally noticed in the early part of the afternoon, in the sunshine, hovering like a humming-bird over the verbenas and phlox.

The moth has the head and thorax dark olive, with a white line on each side. The general ground colour is a rich greenish-olive, tinged with reddish at the sides; on the front part of the body are six longitudinal stripes, while the hinder part is spotted laterally with black and white. The fore-wings deep olive colour, with a straight buff-coloured band extending from the base to the tip; on the outer margin another band of nearly same width, but less distinct colour; the veins are lined with white; the hind-wings black, small, with rose-coloured central band, including a white spot near the inner margin, and a marginal reddish line; fringes white. Expands about three and a half inches. May be readily distinguished from *D. Chamænerii* by its larger size, and *by the white veins in the fore-wings.*

11. Chœrocampa tersa, Linnæus.

Sphinx tersa, Drury.
" " Fabricius.
" " Cramer.
" " Smith & Abbot, Ins. Ga.
Chærocampo tersa, Walker, C. B. M. Lep., Part VIII., p. 131.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Sph. Sm. Ins., p. 171.
" " Grote, 1865.

Mature larva.—Light green, with a large subdorsal crimson ocellus on the fourth segment, containing a blue ring and edged with black and white rings, with six others smaller and similar placed on a white subdorsal line, which begins on the second segment, and extends to the crimson horn. The back is dashed with brown points; breathing places yellow, dotted with black points above and below. (Abbot and Smith.)

The larval transformation takes place in an imperfect cocoon spun on the surface of the ground.

Moth.—Head and thorax brownish-olive, with a lateral whitish line, inclining to roseate at the sides. The body has a broad dorsal dusky band, containing five indistinct darker lines and band of dusky yellow on each side. Fore wings greenish brown, with a small dark brown discal spot and numerous oblique alternate dark brown and yellowish lines, extending from near the base and middle of inner margin to the tip, with a straight brownish sub-marginal line. Hind wings black, with a row of sub-terminal yellow spots. (Clemens.)

Expands 2.70 to 2.80 inches. Length of body 2.55 inches.

12. Darapsa chœrilus, Cramer.

Sphinx chœrilus, Cramer.
" *azaleæ*, Smith and Abbot, Ins. Ga.
Otus chœrilus, Hubner.
Darapsa chœrilus, Walker, C. B. M., Part VIII., p. 183.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 168.
Chœrocampa chœrilus, Harris, Ins. Inj. Veg., p. 328.
Otus chœrilus, Grote, 1865.

Mature larva,—Head green, with a narrow, central brownish line. Body green, deepening on the sides and whitish on the dorsal region, with six oblique irregularly oval whitish bands; breathing places orange; caudal horn bluish-green. (Abbot and Smith.)

Undergoes the pupation in an imperfect cocoon on the surface of the ground. Larva feeds on *Azalea nudiflora*, and, according to Dr. Harris, on *Tradescantia virginica*, Spiderwort.

In this species it is said that during the day the larva conceals itself beneath a leaf, stretching out the body on the mid-rib.

Moth.—Head and thorax ferruginous brown. The abdomen fawn colour, with hairs of the hind portions of segments whitish. The fore wings fawn colour, tinged with reddish from base to middle; a broad ferruginous brown shade crossing the nervules, and composed of three lines, having between them two rows of indistinct fawn-coloured spots; a brown line across the middle of the disk. Hind wings ferruginous, deepening to a ferruginous brown narrow border on the excavated portion of the hind margin; fringes whitish.

13. Darapsa versicolor, Harris.

Chœrocampa versicolor, Walker, C. B. M., Part VIII., p. 131.
Darapsa versicolor, Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 169.
Chœrocampa versicolor, Harris. Ins. Inj. Veg., p. 378.
Otus versicolor, Grote, 1865.

We have not seen any description of the larva, though in the *Canadian Entomologist*, Vol. II., 1870, Mr. W. H. Edwards states that it feeds on the Button Bush, *Cephalantus occidentalis;* and Dr. Harris states that it feeds on *Azalea*, Swamp Pink.

Moth.—Pale green, varied with olive and whitish; a white line on each side of the head, a dorsal white line tinged with reddish, and extending from the head to the tip of the abdomen. The abdominal segments tinged with dark buff, with hind margins dark green and reddish-brown. The fore wings slightly rusty red at the base, with narrow olive-green and dull white bands, the latter tinged with rusty red; an oblique whitish apical line with an olive-green patch adjoining. Hind wings rust coloured, with indistinct greenish terminal margin.

Under-surface of fore wings pale sulphureous, toward the base pale ferruginous; hind wings olive-green, powdered with white at the base.

14. **Darapsa myron**, Cramer.

Sphinx myron, Cramer.
" *pampinatrix*, Abbot and Smith, Ins. Ga.
Otus myron, Hubner.
Darapsa myron, Walker, C. B. M., Part VIII., p. 183.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 168.
Chærocampa pampinatrix, Harris, Ins. Inj. Veg., p. 327.

This moth has already been so fully described in previous reports, that we shall only briefly refer to it here.

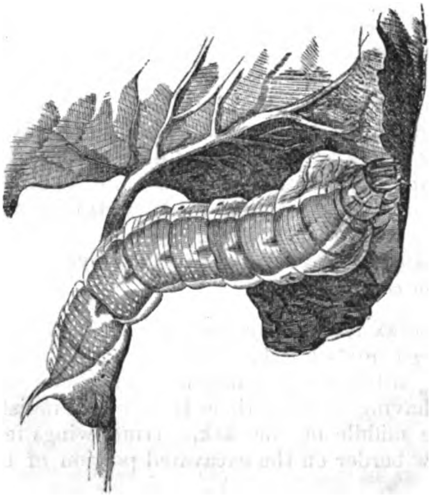


Fig. 27.

The full-grown caterpillar (see fig. 27) is about two inches long, of a pea-green colour, wrinkled transversely, with a pale yellow stripe on each side, and covered with numerous pale yellow dots; the caudal horn sharp and curved backwards. The accompanying figure (27) gives a very good idea of the larva, which has the power of drawing the head and the first two segments of the body within the third segment.

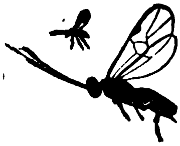


Fig. 28.

The larva is double-brooded, and feeds on the vines and Virginia creeper, *Ampelopsis quinquefolia*. It is much infested by a small ichneumon fly (see fig. 28), which lays its egg in the larva. The larva thus infested always dies. Fig. 29 gives a capital representation of a larva thus attacked.

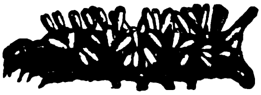


Fig. 29.

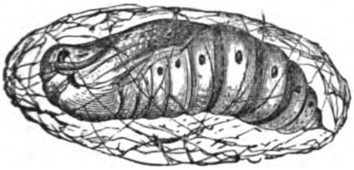


Fig. 30.

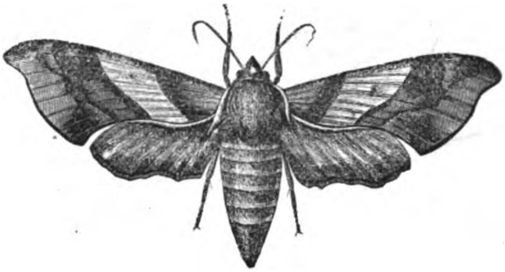


Fig. 31.

The larva forms a loose, brown, silken cocoon (figure 30), among the rubbish on the ground.

The moth (fig. 31) expands from two and a half to three inches, is of an olive-grey colour, except the hind wings, which are rust-coloured; and the fore wings and shoulder covers are traversed with olive-green bands. (Harris.)

15. PHILAMPELUS PANDORUS, Hubner.

Sphinx satellitia, Linnæus.
" " Drury.
" " Fabricius.
Daphni pandorus, Hubner.
Philampelus pandorus, Walker, C. B. M., Part VIII., p. 174.
" *satellitia*, Clemens, Syn. N. A. Ph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 176.
" " Harris, Ins. Inj. Veg., p. 325.
" " Grote, 1865.

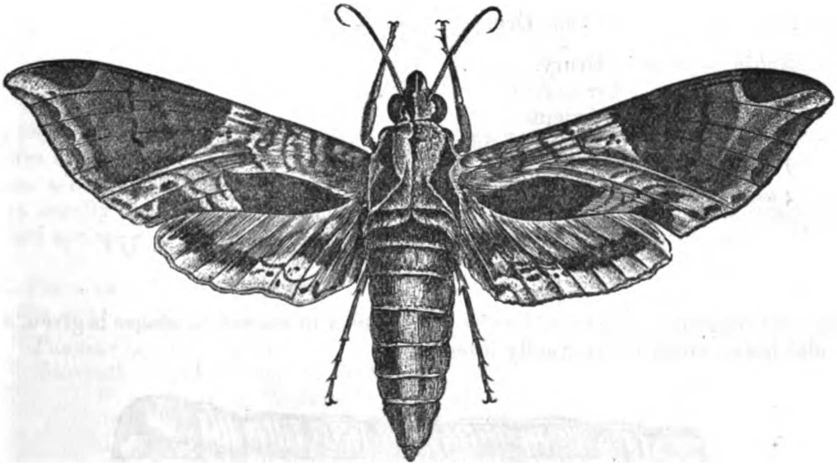


Fig. 32.

The larva (fig. 33) has been well described by Mr. Riley. When first hatched, and for some time afterwards, it is green with pinkish tinge on the sides, and an immensely long straight pink caudal horn. This soon begins to shorten, and finally turns round

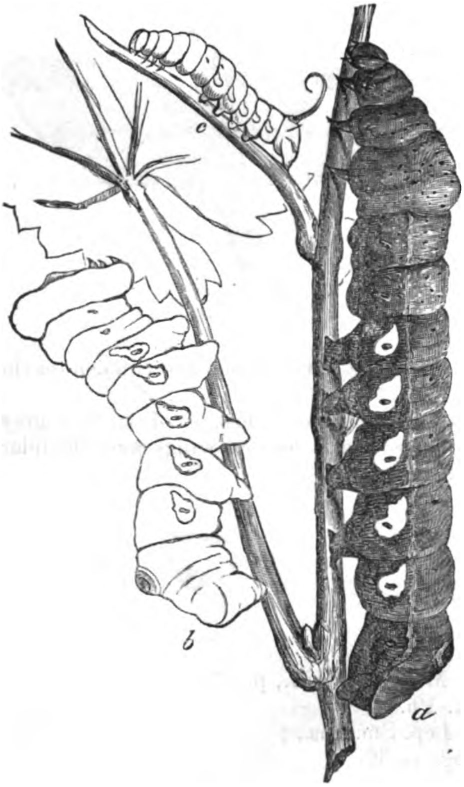


Fig. 33.

like a dog's tail; as the larva grows older it changes to a reddish-brown, and by the third month it entirely loses the caudal horn. It measures when full-grown nearly four inches; it crawls by a series of sudden jerks, and flings its head savagely from side to side when alarmed. The body is pinkish on the back, the sides a darker shade. On the segments six to ten inclusive are five cream-yellow patches, with a black annulation; on segments two to six are numerous small black dots, but on the remaining segments only two; the head reddish-brown. The most common general colour of the full-grown larva is a rich velvety brown—vinous brown.

It feeds on the leaves of the grape vine and Virginia creeper. They consume great quantities of leaves, often stripping bare the branches they attack.

The pupation occurs, according to Mr. Lintner, in a ground cell, constructed at a very moderate depth. The chrysalis is chestnut-brown, about two inches long, with a long thick terminal spine, slightly forked; the moth generally appears the following June. The moth (fig. 32) expands from four to five inches, and is of a light olive colour, variegated with patches of darker olive-green; the antennæ long, slender, and tapering at the extremity into an ample hook, with seta or bristles. This form of the antennæ is characteristic of the genus.

16. PHILAMPELUS ACHEMON, Drury.

Sphinx achemon, Drury.
" *crantor*, Cramer.
" " Fabricius.
" " Abbot and Smith.
Pholus " Hubner.
Philampelus achemon, Walker, C. B. M.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 177.
" " Harris, Ins. Inj. Veg., p. 325.

Like its congener, *P. pandorus*, the young larva in its earlier stages is green, and has the caudal horn, which it eventually loses.

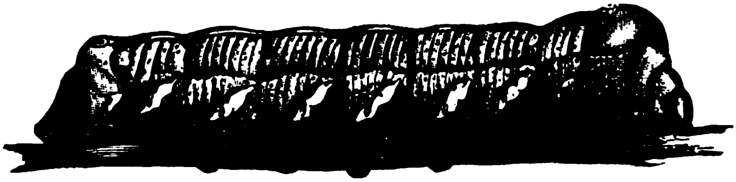


Fig. 34.

The full-grown larva (fig. 34) is about three inches long, and has the head reddish-brown; body pale reddish-brown on the back, with a darker vascular line, and pale reddish subdorsal line on each side, and the general colour deepened laterally. It has six scalloped cream-coloured patches, bordered with white, containing the breathing places or stigmata. There are from six to eight transverse wrinkles on all but the thoracic and caudal segments. The lenticular caudal tubercle is black, polished, and contained in a brown patch edged with black and white lines. The larva is covered with minute spots, which are dark on the back, but are light and annulated on the sides. The head, which is small, the front segments and breathing holes are somewhat flesh-coloured, while the prolegs and caudal plate are deep brown. Feeds on the vine and Virginia creeper. Before going into chrysalis it often changes to a beautiful pink or crimson colour. It burrows in the ground, and after making a smooth cavity, undergoes its pupa state. The chrysalis (fig. 35) is of a dark shining mahogany-brown colour, roughened, especially on the anterior edge of the segments in the back. The moth (see fig. 36) expands from three to four inches; it is of a reddish ash colour, variegated with light brown, with two triangular patches of deep ferruginous on the thorax, margined with whitish, and two square ones on each fore wing; the hind wings are pink, with a dark shade across the middle, still darker spots below this shade, and a broad ash-coloured border behind.

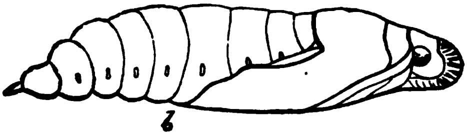


Fig. 35.

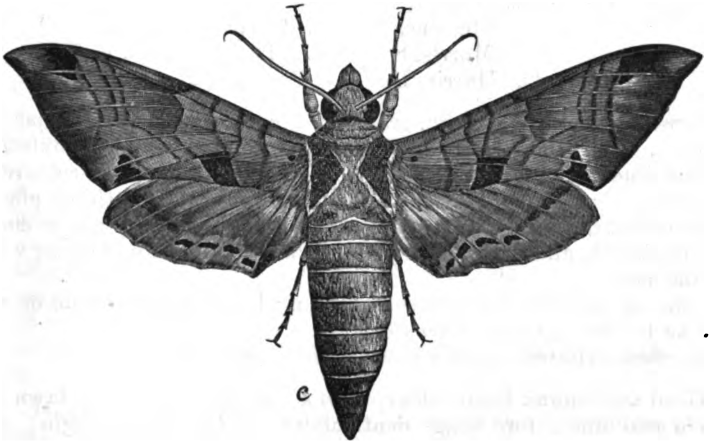


Fig. 36.

It is usually single brooded, the chrysalis remaining in the ground during the fall, winter and spring, and producing the moth about the end of June.

17. **Paonias myops**, Abbot and Smith.

Sphinx myops, Abbot and Smith
Paonias myops, Hubner.
Smerinthus rosacœurum, Boisduval.
" *myops*, Walker, C. B. M.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 207.
" " Harris, Ins. Inj. Veg., p. 328.

Mature larva.—"Head bluish-green, with a bright yellow line on the sides. Body bluish-green, with a row of subdorsal and stigmatal reddish-brown spots; six oblique lateral bright yellow bands, with two thoracic subdorsal yellow lines; caudal horn yellow on the sides."

Mr. G. W. Peck, of New York, found that the red blotches on larvæ are not uniform, and are more prevalent on the late brood, though some are entirely green and correspond in colour to similar spots found on the leaves of the wild cherry at that season.

The larva feeds on the leaves of the wild cherry, and undergoes transformation in the earth; the chrysalis is smooth and of a deep brown colour.

Moth.—Head and thorax chocolate-brown, the two latter portions with a purplish or rosy tinge; the sides of the palpi, and a stripe in the middle of the thorax, tawny-yellow; abdomen brownish, with tawny-yellow spots, and the hind portions of the segments dark brown; fore wings angulated and excavated on the hind margin; chocolate-brown colour, with a faint purplish or reddish-grey tinge towards the base; black and chocolate-brown bands and patches; hind wings dull yellow, with the outer half chocolate-brown; short bluish lines above the tips, and a dull yellow spot upon it; the ocellus (or eye-shape spot) black, with a large pale-blue pupil.

This moth is double brooded.

18. PAONIAS EXCÆCATUS, Abbot and Smith.

Sphinx excæcata, Abbot and Smith.
Paonias excæcatus, Hubner.
Smerinthus excæcatus, Walker, C. B. M.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 208.
" *excæcata*, Harris, Ins. Inj. Veg., p. 327.

Mature larva.—Head apple-green, granulated, flattened, and triangular, with bright yellow side lines; body light-green, studded with pointed white granulations; seven oblique yellowish lines on each side; caudal horn nearly straight, rose-coloured, yellow at sides and sometimes at tip; legs at tips reddish-brown; breathing places reddish-brown. Larva undergoes transformation in the ground. The chrysalis is dark chestnut-brown, tolerably smooth, and with a short triangular rough terminal spine, which is more prominent in the male.

Feeds on the leaves of the apple tree and plum; has also been found on the elm, and is said to feed on the swamp rose, *Rosa Carolina.*

The larva, when irritated, emits a musical chirping sound.

Moth.—Head and thorax fawn colour, with a roseate tinge; body fawn colour, with a dark-brown dorsal line; fore wings denticulated on the hind margin; fawn colour clouded with brown, with black and brownish-red spots and patches; hind legs rose colour in the middle, with a brownish patch at the tip, crossed by two or three short whitish lines; ocellus (or eye spot) black, with pale-blue centre and short whitish lines between the ocellus and the inner margin.

19. SMERINTHUS GEMINATUS, Say.

Smerinthus geminatus, Say. Am. Ent. Lec. Ed.
" " Walker, C. B. M.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 210.

Larva in earlier stages uniform pale-green; when full grown measures about two inches in length. Colour pale-green, whitish dorsally; head, triangular, granulated in pale-green in front, and in white at the sides; body tapering slightly in front segments; seven lateral pale-yellow bands, the last much brighter; a whitish stripe down the centre of the back; anal shield granulated, and of the same dark-green colour as the under surface. Caudal horn straight, granulated and violet-coloured. Breathing places elliptical and reddish; legs, reddish; prolegs, green. Feeds on willow.

Dr. Clemens states that he has secured numbers of the pupa from the middle of October to beginning of November at the base of willows.

Moth.—Palpi reddish-brown; head, thorax, in front and tegulæ (shoulder covers) whitish or pale-grey, with a large deep chestnut semi-oval patch on top of the thorax; body brownish-grey; fore wings angulated and excavated on the hind margin; grey colour fringed with rosy and with dark-brown streaks and patches; hind wings rosy, along exterior and terminal border yellowish-grey. The ocellus (or eye spot) is black, emitting a short broad line to inner angle, and with two or three blue pupils; these last give rise to the name *geminatus*, or twin-spotted, and cause the moth to be readily distinguished from the preceding one, *S. excæcatus.*

20. CRESSONIA JUGLANDIS, Abbot and Smith.

Sphinx juglandis, Abbot and Smith.
Amorpha dentata juglandis, Hubner.
Smerinthus juglandis, Walker, C. B. M.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 213.
" " Harris, Ins. Inj. Veg., p. 328.
Cressonia " Grote and Robinson. 1865.

Mature larva.—Head large, pointed apex, colour light-green, with white granulations on the sides; body slender, tapering towards the extremities; pale apple-green, granulated regularly on the transverse wrinkles, seven oblique lateral bands, lighter green, approaching white (Lintner), or crimson-edged beneath, with pale-yellow (Clemens), or bright-yellow (Packard). Caudal horn brownish, with dense blackish spinules; feet dark reddish-brown. Length about two and a quarter inches.

Feeds on Black Walnut, *Juglans nigra*, Hickory, *Carya alba*, Iron Wood, *Ostrya Virginica*, and Wild Cherry.

According to Dr. Clemens, the position of the larva when at rest is not sphinx-like; it is extended along the mid-rib of a leaf, and when disturbed throws its head from side to side, making a crepitating noise. It attains its growth about the middle of September, and undergoes its transformation in a cell just beneath the surface.

Pupa is blackish-brown, with the terminal segments of the abdomen flattened; several conical granulated projections or prominences on the front of the head case and on the leg cases.

Moth.—Head and thorax pale fawn colour or greyish, with a dorsal brownish stripe; abdomen fawn colour; front wings, pale grey, with lilac tinge, with broad yellowish-brown shade across them; hind wings ochraceous-brown, or dull fawn colour, with a central light-coloured band edged by dark lines on each side. No eye spots, or occelli on the wings.

21. AMORPHA MODESTA, Harris.

Smerinthus modesta, Harris, Agassiz, Lake Sup.
" *modestus*, Walker, C. B. M.
" *modesta*, Clemens, Syn. N. A. Sph.
" *modesta*, Morris, Syn. N. A. Lep. Sm. Ins., p. 210.
Amorpha modesta, Hubner.

Larva when young is green-coloured, and has a short purple caudal horn, which it loses almost altogether at maturity. It measures when full-grown about three inches, being three-quarters of an inch in diameter. The breathing places small and rust red. Legs brown; prolegs brownish-yellow; yellowish-white oblique lines on the side, which are much more visible in the earlier stages of the larva.

Feeds on the Lombardy poplar.

Pupa two inches long, cylindrical and dark chestnut-brown, terminating in a point or thorn.

Mr. R. Bunker, of Rochester, who has reared this larva from the egg, states that "the habits of the larva are singular; before the first moult it is much inclined to wander, and goes looping along after the manner of the Geometers; after the second moult it becomes sluggish. It is a voracious eater—in short, an accomplished gastronome. Its manner of feeding differs from that of any larva I have had the pleasure of rearing. It rests with its body stretched out at right angles to the edge of the leaf, and eats with its feet fixed on the side of the leaf, and as the food is consumed moves backward, and when the leaf is consumed to the mid-rib, leaves it to try its gormandizing propensities on a fresh one. As the worm, while feeding, rests as above mentioned, the reason of its leaving the leaf half consumed will be obvious—it would otherwise have no surface to hold on to."

Moth is very large, expanding nearly six inches. The palpi, head, thorax, and abdomen, olive-coloured; fore wings denticulated on hind margin; pale olive colour, with an indistinct irregular darker streak across the middle, and margined towards the base of the wing with a still paler hue; a broad, deep olivaceous median band, containing a pale angular discal spot, and darkest at base of wing; two other bands of same colour but different shades across the wings; hind wings purplish-red in the middle, with a transverse black spot above inner angle, and a blackish olivaceous patch beneath it. In the male, the wing is olivaceous exteriorly and along terminal border.

22. CERATOMIA AMYNTOR, Hubner.

Agrius Amyntor, Hubner.
Ceratomia quadricornis, Walker, C. B. M.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 205.
" " Harris, Ins. Inj. Veg.. p. 323.
" *Amyntor*, Grote and Robinson, 1865.

Larva.—When full grown is about three and a half inches long, of a pale green colour, sometimes deep brown, seven oblique greenish-white lines on each side of the body, and a row of little notches like saw teeth on the back; body strong, shagreened or granulated; on the shoulders are four short, obtuse, fleshy notched horns; caudal horn greenish and of medium length, slightly curved; stigmata, or breathing places, black, encircled with yellow and divided by a yellow line; feet reddish; found in May and June; feeds on the American elm (*Ulmus Americana*); undergoes pupation in the ground; pupa dark brown, smooth; tongue-case not apparent.

Moth.—Expands nearly five inches; head grayish; thorax with the top fawn colour or greenish-brown, whitish at the sides; abdomen fawn-coloured or brownish, with a slender black dorsal line and two black stripes at each side; fore-wings fawn colour, varied with blackish-brown, three or four blackish irregular lines across the inner margin to about the middle, a white discal spot with a black discal dash resting on the median nerve (in the males the discal spot is fawn colour); hind-wings pale brownish, with a subterminal blackish or dark brown band and shaded with blackish in the middle, or forming indistinct dark-coloured lines.

23. DAREMMA UNDULOSA, Walker.

Sphinx Brontes, Boisduval.
Daremma undulosa, Walker, C. B. M.
Ceratomia repentinus, Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 206.
Sphinx " Grote, 1865.
Daremma " Grote and Robinson, 1865.

Larva.—Full grown, about one and a half inches long; head light green, with broad lateral whitish stripes; body pale green, with seven oblique whitish-green bands on the sides, bordered with darker green; caudal horn green, rose-coloured at base tipped with yellow, slightly curved and covered with black spinules; the breathing pores have a white dot at each extremity and are bordered with orange; legs rose-coloured; prolegs green; feeds on ash (*Fraxinus*) of different species and the lilac (*Syringa vulgaris*); enters the earth and undergoes the pupal state about four inches below the surface; pupa about one and three-quarter inches long, dark brown colour, much granulated or shagreened, with triangular rough terminal spine.

Moth.—Head and thorax dark grey, paler on the side; shoulder covers with central black stripe; abdomen dark grey, paler on the sides, with slender black dorsal line with two black stripes on each side; fore-wings pale, or rather deep ash colour varied with black and white; discal spot white and black margined; black wavy lines across wings with white spaces between; hind-wings blackish-grey, with three parallel narrow, wavy black bands; fringes white, spotted with dark brown.

24. SPHINX QUINQUEMACULATA, Haworth. (*See* Fig. 37).

Sphinx quinquemaculatus, Haworth.
Phlegethontius Celeus, Hubner.
Sphinx quinquemaculatus, Stephens.
" " Wood.
" *quinquemaculata*, Walker, C. B. M.
Macrosila " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 190.
Sphinx quinquemaculatus, Harris, Ins. Inj. Veg., p. 322.
" *quinquemaculata*, Fitch, 9th Report.

Larva known as THE Tomato or Potato Worm; has been so often described that it must be familiar to most:

It measures about three inches in length, is smooth and wrinkled transversely; head green, small and shining, with a black stripe on each side; the breathing pores black, except the two last, which are yellow; the usual colour bright green marked with white, with seven straight oblique greenish-yellow stripes; body dotted with numerous greenish-yellow spots.

Caudal horn long, slightly curved backward and granulated; variations of colour are very great; common colour is leek-green, from this it varies to lighter green, and to various shades of darker brownish and blackish green; in other instances the green wholly vanishes and the worm is pale or deep amber-brown, blackish-brown, purplish-black or pure black; a voracious feeder and does much damage to the tomatoes and potatoes.

Pupa is a bright glossy chestnut colour, with a long and slender tongue case bent over from the head so as to touch the breast only at the end, and somewhat resembling the handle of a pitcher.

The *Moth* expands about five and a half inches, is of a grey colour, variegated with blackish lines and bands; on each side of the body are five round orange-coloured spots encircled with black. Its tongue when unrolled is nearly six inches long, but when not in use is concealed, like that of all the Sphingidæ, between the palpi, coiled like a watch-spring.

25. SPHINX CHERSIS, Hubner.

Lethia chersis, Hubner.
Sphinx cinerea, Walker, C. B. M.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 194.
" " Harris, Ins. Inj. Veg., p. 328.
" *chersis*, Grote and Robinson, 1865.

Larva bright green colour; head bluish, with two pale side bands; seven bright yellow oblique bands on each side, edged above with bluish-green; caudal horn medium length, pale blue colour, sometimes rose, and curved at the tip; anal plate triangular, dotted with black points; legs blackish-blue; prolegs green with black tips; breathing

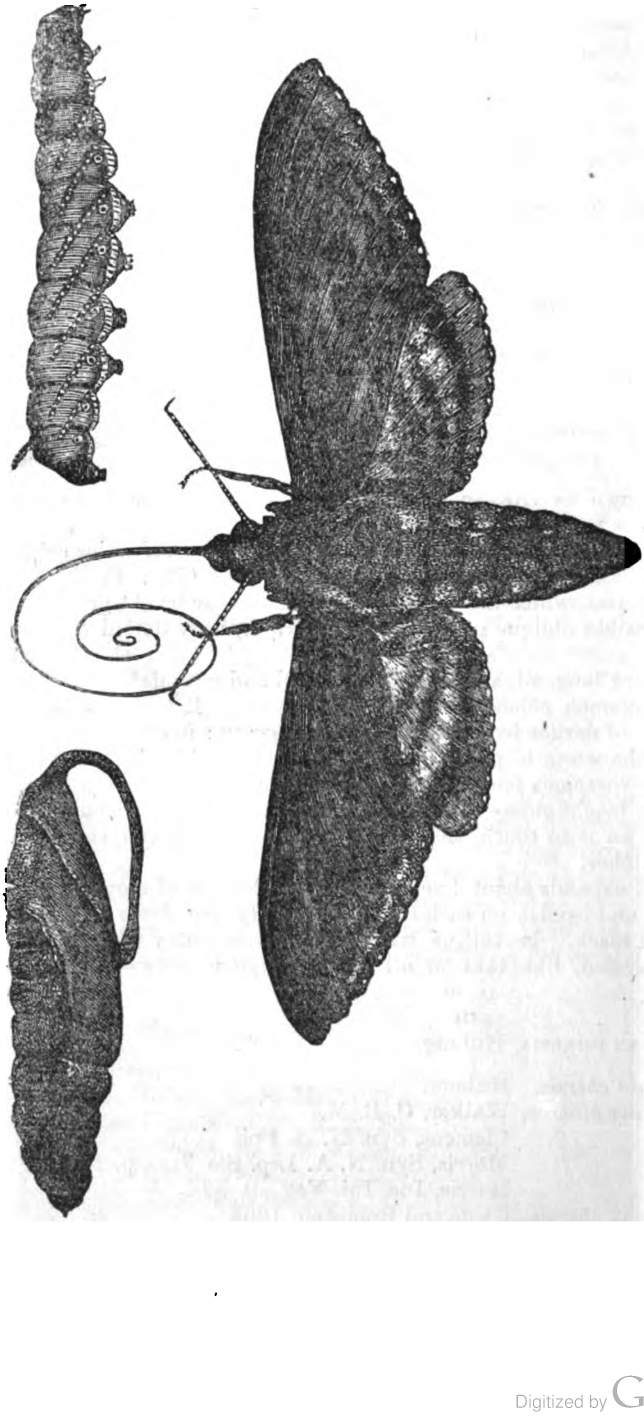


Fig. 37.

pores orange; length, two and a half inches; feeds on lilac, *Syringa vulgaris;* has been also taken on the white ash, *Fraxinus Americanus*, and privet, *Ligustrum vulgare.*

Pupa has tongue case detached and is contained in subterranean cell; chestnut-brown colour.

Moth.—Head and thorax dark grey; shoulder cases tipped with whitish with a black line and a spot on each side; abdomen dark grey, with a black dorsal line and alternate black and white lateral demi-bands; fore-wings dark grey, with black spot at base, a fine black discal line and blackish lines across the wings; hind-wings sordid grey, with a broad median and a terminal black band.

26. SPHINX DRUPIFERARUM, Abbot and Smith.

Sphinx	*drupiferarum,*	Abbot and Smith.
Lethia	"	Hubner.
Sphinx	"	Walker, C. B. M.
"	"	Clemens, Syn. N. A. Sph.
"	"	Morris, Syn. N. A. Lep. Sm. Ins., p. 197.
"	"	Harris, Ins. Inj. Veg., p. 328.

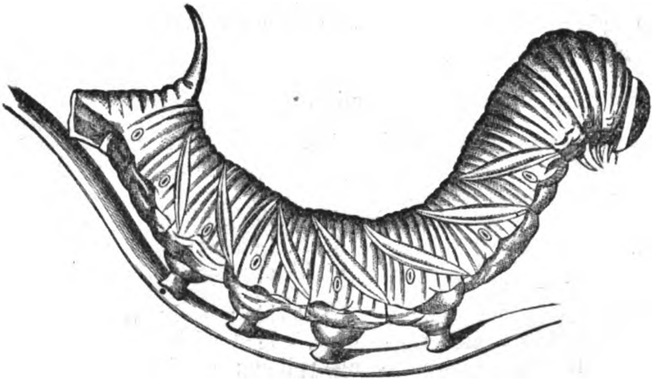


Fig. 38.

Larva (fig. 38) when full-grown measures about three inches, apple-green colour; head green, with lateral brown or black stripes; on the sides are seven broad oblique bands, white, bordered in front with light purple or mauve; breathing pores distinct and of a bright orange colour; caudal horn long, dark brown, yellow at base; body cylindrical and smooth; feeds on the plum and hackberry (*Celtis occidentalis.*) Appears in July and August. Enters the ground for transformation.

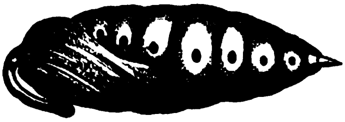


Fig. 39.

Pupa (fig. 39) about one and a half inch long, dark reddish-brown; has a short thick projecting tongue case.

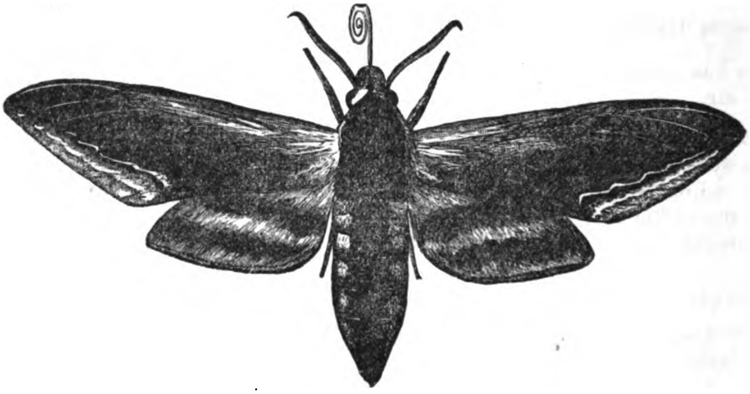


Fig. 40.

Moth (fig. 40) expands about four and a quarter inches; head and throat blackish-brown, whitish-fawn colour at sides; abdomen brown, with a slender dorsal line and a lateral black band on each side containing brownish-white spots; fore-wings dark purplish-brown, with whitish lines on margin; hind-wings whitish, with broad median black band enlarged towards the margin, and sub-terminal black band and fawn-coloured margin.

27. SPHINX KALMIÆ, Abbot and Smith.

Sphinx	*Kalmiæ*,	Abbot and Smith.
Lethia	"	Hubner.
Sphinx	"	Walker.
"	"	Clemens, Syn. N. A. Sph.
"	"	Morris, Syn. N. A. Lep. Sm. Ins., p. 196.
"	"	Harris, Ins. Inj. Veg., p. 328.

Larva.—Head green, with black stripe at side; body pale green, or yellowish-green; seven oblique pale yellow bands on the sides, edged with blackish-green, and with pale blue above that; breathing pores orange-yellow; caudal horn blue, covered thickly with black tubercles, slightly curved; length about three inches; feeds on lilac or mountain laurel (*Kalmia latifolia*) and ash; undergoes pupation in the ground; pupa dark brown, tongue case exserted with bulbous extremity; goes into pupa about August or September, moth appearing in June or July.

Moth.—Head and thorax rusty brown, paler on the sides; shoulder covers with black lines and patches; abdomen rusty brown with central black line and alternate whitish and black demi-bands; fore-wings rusty brown, paler in the middle, rusty brown streaks, a whitish line near margin; small rusty discal spot, reddish-brown fringes; hind-wings, brownish-white, with broad central and terminal black bands; outer margin and fringes reddish-brown.

28.—SPHINX GORDIUS, Cramer.

Sphinx	*gordius*,	Cramer.
Lethia	"	Hubner.
Sphinx	*pœcila*,	Stephens, Ill. Brit. Ent.
"	"	Wood.
Sphinx	*gordius*,	Walker, C. B. M.
"	"	Clemens, Syn. N. A. Sph.
"	"	Morris, Syn. N. A. Lep. Sm. Ins., p. 198.
"	"	Harris, Ins. Inj. Veg., p. 328.

Larva said to be very like that of *S. drupiferarum;* feeds on the apple-tree. Larval transformation is subterranean; pupa with short detached tongue case.

Moth.—Head and top of the thorax blackish-brown, or black and reddish-grey on the sides; abdomen dark grey, with a dorsal black line and alternate black and greyish demi-bands; fore-wings blackish-grey with a roseate hue, white, conspicuous discal spot, blackish streaks and lines; fringes dark brown, spotted with white; hind wings grey, with a black median and a broad black marginal band, the fringes white.

29. SPHINX EREMITUS, Hübner.

Agrius eremitus, Hubner.
Sphinx sordida, Walker, C. B. M.
" " Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 194.
" *eremitus,* Grote and Robinson, 1865.

Larva three and a half inches long, sepia coloured, slightly granulated like "shagreen," having a varnished appearance; caudal horn black, rather small. The first segments (*i.e.* to which the prolegs are attached), horn coloured and semi-transparent, having two black shield-shaped blotches upon them, of which the hinder is much larger than the former; prolegs black; seven oblique whitish lateral bands, the hindmost of them broader than the others; breathing pores black; head greenish-brown, with distinct white stripe on each side. (Fyles.) According to Prof. Snow the general colour of body is pale green; this may be only a variation like that of *S. 5 maculata.* Found in September and October, feeding on *Salvia officinalis,* common sage; moth appears in May or June; said to be double brooded.

Moth.—Brownish-cinereous or ash colour; head and thorax paler at sides; broad blackish stripe on shoulder covers; brown dorsal line on top of thorax and black spots; abdomen with dorsal black line and alternate black and whitish demi-bands on the sides; beneath, white with central blackish spots; fore-wings brownish-ash colour, with a black margined white discal spot with short blackish dash through it, blackish streaks across wings; a short blackish-brown line edged on the outside with greyish near the terminal margin; hind-wings yellowish-white, with black spot at base, and a median and broad marginal black band; length of body sixteen lines; expansion of wings thirty-five lines.

30. SPHINX LUSCITIOSA, Clemens.

Sphinx luscitiosa, Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 197.

Larva and pupa undescribed.

Moth.—Antennæ and palpi blackish-brown; head and thorax blackish-brown or blackish and white at sides; abdomen brown, with a black stripe on each side; fore-wings, pale brown with a rusty hue, the inner border dark smoke colour; a terminal smoky band tapering to the tip of the wing, with a wavy outline in front; a slender black discal line and black lines and streaks across the wings; fringes blackish; hind-wings yellowish, with a broad terminal black band and the fringes whitish.

31. DOLBA HYLÆUS, Walker.

Sphinx Hylæus, Drury.
" " Cramer.
" " Fabricius.
" *Prini,* Abbot and Smith.
Hyloicus Hylæus, Hubner.
Sphinx Hylæus, Walker, C. B. M.
Dolba Hylæus, Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 203.
Sphinx Hylæus, Harris, Ins. Inj. Veg., page 328.

Mature larva.—Head green, with a pale blue line on each side; body pea-green, with lateral oblique pink bands edged below with white; caudal horn crimson; *pupa* reddish-brown; tongue case not apparent. (Abbot and Smith.) Feeds on black alder (*Prionos glaber*) and whortleberry.

Moth.—Head and thorax brownish rust-colour, whitish on the sides; two white spots on top of thorax, two black ones below it; abdomen brownish rust-colour, with a row of dorsal brown spots and a double row of white spots, and with lateral alternate black and narrow white demi-bands; fore-wings dull rust-colour or dark brownish, varied with white and blackish-white spot at base, discal spot white and black margined, a band of blackish lines crossing the middle of the wing, margined at the end broadly with whitish, and black circlets on the hinder ends of the middle veins; hind-wings whitish, with an indistinct double median blackish band, a broad terminal dark brown band edged above with blackish.

32.—ELLEMA HARRISII, Clemens.

Anceryx coniferarum, Walker, C. B. M.
Ellema Harrisii, Clemens, Syn. N. A. Sph.
" " Morris, Syn. N. A. Lep. Sm. Ins., p. 216.
Sphinx coniferarum, Harris, Ins. Inj. Veg., p. 328.

Larva two inches long, the body being smooth and nearly cylindrical, and thickest in the middle; the head is large, pointed above, flat in front, and green, with a yellow stripe on each side; body bright green, with a dorsal row of dark-red spots on the fifth to the twelfth segments inclusive, with a bright yellow stripe on each side of the reddish spots, and a lateral white stripe mixed with yellow; prolegs rose-coloured, and a ventral stripe of same colour; has no caudal horn. Found in September feeding on the white pine.

Pinus strobus.—Dr. Guthrie says, "I have taken the larva about the middle of September beneath or ascending the trunks of the white pine, from the leaves of which it seems liable when near maturity to be shaken by the high winds."

Pupa.—Chestnut brown; tongue case buried; very difficult to rear in confinement.

Moth.—The palpi, head and thorax pale-umber, with the sides of the thorax at base of fore wings, and the lower portion of shoulder-cases greyish. Abdomen brownish-gray. Fore wings umber-coloured, varied with pale grey; blackish-brown lines crowning the wings, with blackish moon-shaped spots between the veins; ends of veins tipped with dark-brown; fringes brown, spotted with white; lighter towards the base.

NECROPHORI—BURYING BEETLES.

BY J. FLETCHER, OTTAWA.

The several classes of beneficial insects may be grouped under two heads:—First there are those which do actual good themselves; and, secondly, those which prevent others from doing harm. It is of the utmost importance that the appearance of all these beneficial insects should be known to those engaged in agricultural pursuits, or many of the most useful of man's auxiliaries, will, without doubt, be frequently destroyed This is a very easy matter, for the members of the different families, into which insects are classified by entomologists, may nearly always be recognized as such, at a glance, and with very few exceptions the different genera of any family have the same habits.

From the small size of insects, the enormous benefits and injuries which man experiences at their hands, are apt to be underrated or even overlooked altogether. They are, however, becoming more appreciated, day by day, as the labours of specialists are made known to the world; a remarkable illustration of this may be found in the publication of Mr. Darwin's last work, "Vegetable Mold and Earth Worms." Notwithstanding the vast amount of original investigation, of the utmost importance, on other scientific subjects undertaken by this gentleman, the fruits of which have from time to time appeared in his invaluable works, ever since 1837, when he read a paper on "The Formation of Mold," to the Geological Society of London, he has been accumulating facts and making observations, the results of which are set forth in this fascinating work. Some of the experiments are most remarkable, and the care and patience exhibited by this great worker in carrying them out, are very characteristic of the man; and are so graphically narrated that one who reads the book can almost fancy he has seen them performed. The modifications of the earth's surface by the agency of these small creatures is so great as to be almost incredible, were they vouched for by a less accurate experimentalist than Dr. Darwin. As the result of various careful observations he found that, on one acre of old pasture ground no less than fifteen tons of earth are annually swallowed by worms below the surface, and thrown up above it in the shape of castings.

He points out, too, that the burial of ancient Roman and other remains, scattered over the country, in England, is due to worms, which keep continually throwing up the soil from underneath them, and so let them sink.

Among the insects which do actual good, those which perform the office of scavengers are entitled to more than a passing consideration. These useful insects will be found almost entirely among the Coleoptera or beetles, and the Diptera or flies. As Kirby and Spence's valuable work, "Introduction to Entomology," is not easily attainable in this country, I cannot do better than insert what they have written so well on this subject:—
"All substances must be regarded as nuisances and deformities, when considered with relation to the whole, which are deprived of the principle of animation. In this relation stand a dead carcase, a dead tree, or a mass of excrement, which are clearly encumbrances that it is desirable to have removed, and the office of effecting this removal is chiefly assigned to insects, which have justly been called the great scavengers of nature."

"How disgusting to the eye, how offensive to the smell, would be the whole face of nature were the vast quantities of excrement, daily falling to the earth from the various animals which inhabit it, suffered to remain until gradually dissolved by the rain, or decomposed by the elements! That it does not thus offend us, we are indebted to an inconceivable host of insects, which attack it the moment it falls; some immediately begin to devour it, others depositing in it eggs from which are soon hatched larvæ that concur in the same office with ten-fold voracity; and thus every particle of dung, at least of the most offensive kinds, speedily swarms with inhabitants which consume all the liquid and noisome particles, leaving nothing but the undigested remains, that soon dry, and are scattered by the winds, while the grass upon which it rested, no longer smothered by an impenetrable mass, springs up with increased vigour." Many of the Scarabæidæ or Diggers not only live on this filthy material, but dig galleries below the mass into the soil and carry down portions of it, to be food for the young larvæ; the benefit thus conferred is two-fold: not only is the nuisance removed, but a fertilizer is carried down into the soil, and canals are opened by which more may find its way in the same direction, whenever rain falls. The beetles living in dung inhabit it in their perfect as well as larval states; and it is a curious fact, but they are very seldom found to have any of it adhering to them.

"Of the diptera, the larvæ alone derive their nutriment from this source; the imago, which would be suffocated did it attempt to burrow into a material so soft, only lays its eggs in the mass. The members of this order, too, are more select in their choice than the coleoptera—not indeed as to delicacy—but they do not indiscriminately oviposit in all kinds, some preferring horse-dung, others cow-dung, and others that of birds, etc.

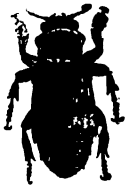
"Still more would our olfactory nerves be offended, and our health liable to fatal injuries, if the wisdom and goodness of Providence had not provided for the removal of another nuisance from our globe—the dead carcasses of animals. When these begin to grow putrid, everyone knows what dreadful miasmata exhale from them, and taint the air we breathe. But no sooner does life depart from the body of any creature than myriads of different sorts of insects attack it in various ways. First come the Histers, and pierce the skin; next follow the flesh-flies some (Sarcophaga), so that no time may be lost, having the remarkable characteristic of depositing their young alive; others covering it with millions of eggs, whence in a day or two proceed innumerable devourers. An idea of the despatch made by these gourmands may be gained from the combined considerations of their numbers, voracity, and rapid development. One female of *Sarcophaga carinaria* will give birth to 20,000 young; and the larvæ of many flesh-flies, as Redi ascertained, will, in twenty-four hours, devour so much food, and grow so quickly, as to increase their weight two hundred-fold. In five days after being hatched they arrive at their full growth and size, which is a remarkable instance of the care of Providence in fitting them for the part they are destined to act: for if longer time were required for their growth, their food would not be a fit aliment for them, or they would be too long in removing the nuisance it is given in charge to them to dissipate."

As soon as the various tribes of flies have opened the way, and devoured the softer parts, a whole host of beetles actively second their labours. Wasps, hornets and ants claim a share, and before long what was a putrifying mass is only a heap of dry bones, which are soon covered by decaying vegetables and soil thrown up by worms.

Of these scavenger-beetles, none, perhaps, are more interesting than the *Necrophori* or Sexton Beetles, or, as their name denotes, corpse-bearers, in allusion to the singular habit possessed by all the beetles of this genus. They are not content with merely eating their food when they find a supply, but lay eggs in it and then bury it so that no other insects may get it, but that it may be a provision for their future progeny.

These insects may easily be known; they are almost all bright coloured, being of a shining black, ornamented with bright orange markings and fulvous-down underneath, the under side of the elytra is often of a bright yellow colour, which is very conspicuous when they are flying, these organs then being held erect. They fly and run with great rapidity. When flying they are very difficult to distinguish from Humble-Bees, and have very much the same oscillating mode of flying backwards and forwards before any one trying to catch them. The antennæ are very peculiar, consisting of a slender jointed stem, bearing at its end a round nob composed of four flattened joints joined together. There are several species found in Canada, the largest and handsomest of which is *Necrophorus Americanus*, Oliv. I have never been able to observe this species working; but some of the other species may be easily watched if a trap is set for them in the shape of some small animal or bird

Fig. 41.



Represents one of our commonest species (*Necrophorus Velutenus*).

The rapidity with which these small creatures will bury a bird many times larger and heavier than themselves, is astonishing. They seem, too, to be gifted with the same instinct as the vulture, for although they are very seldom found hidden like other insects, no sooner is a small dead animal exposed than some of these insects very soon appear, and, after a short survey of the "subject," soon commence operations. If the ground is soft and suitable, they begin at once by making a furrow all round, about the length of their bodies from the animal; the greater part of this work of burying is said to be performed by the male, but I have been unable to verify this. They nearly always work at night, and stop and run under the body whenever a light is brought near them. As soon as the first furrow is completed, another is begun inside this, and the earth is then pushed out into the outside one; the next furrow is beneath the body, and the progress can be marked by the earth that is pushed out all round it from underneath. There is a good deal of running about and inspecting all the time the work is going on, and frequently the workmen will refresh themselves with a meal from the object of their attentions, after which they will take a rest and then will start again, and work away until nothing is visible. They are not even then content, for they will sink small bodies to the depth of a foot from the surface. In this storehouse they deposit their eggs, and then leave them to take care of themselves, and set off in quest of more work to do. If by chance the object they wish to bury is in an unsuitable place, they will accomplish comparatively enormous feats rather than give up the object. Last summer, I noticed one evening a dead swallow lying on a stone pavement close against a building. As I passed I pushed it up against the wall so as to be out of the way; the next morning as I went by the same place I looked if it were still there; but not seeing it, was passing on again, when, on the opposite side of the path, and half buried behind a tuft of grass, I found it, and in the feathers and underneath the bird were at least half a dozen Necrophorus velutinus, four of which I secured. The distance this had, to all appearances, been dragged in one night, was over six feet four inches. Soon after the eggs and their decomposing receptacle are buried, the young larvæ hatch and begin to devour. They soon grow into long, fleshy grubs, narrowed at each end and having the segments distinctly marked, and the upper surface of each one armed with a horny plate, which has strongly toothed edges. These plates serve the larva in the stead of legs, of which it has only three very weak and small pairs. With the assistance of the horny segment-plates, it is enabled to force its way through the soft material in which it lives by alternately lengthening and shortening its body. As these insects during this period never change their locality, legs are useless; but when, after having spun a cocoon, in the earth laid dormant all the winter, and emerged the following spring as perfect insects, they lead an active, roving life, strong and slender legs, suited to their requirements, are provided, showing how nothing useless is created in nature, and how no necessary is found to be wanting.

There are many curious instances on record of the instinct displayed by these insects in providing food for their future young. In Westwood's "Modern Classification of Insects," mention is made of an instance in which some of these insects, in order to get possession of a mole fastened to a stick stuck upright in the ground, undermined the stick so that it soon fell to the earth. From an observation by M. Cadet de Vaux, it appears that while several individuals of some species of Necrophorus labour in concert, those of others work alone.

Latreille states that the larvæ of Necrophorus entirely consume the buried carcass, leaving neither skin nor bone. Hence it seems that the number of workers is proportioned to the quantity of food necessary for the support of their progeny.

One of the most objectionable features about these handsome and interesting insects is a habit they have of exuding a most fetid fluid, which is derived from the putrid food they feed upon. Unluckily, none of their tribe are free from this objectionable habit, and they never entirely lose the odour.

Among those insects which do good by preventing others from doing harm are found those predacious kinds which live on other insects, and they adopt the most effective means, viz., killing and eating all they find. They belong chiefly to the following families: *Cicindelidæ*, or Tiger-Beetles, are bright metallic-tinted, merciless freebooters, armed with sharp, cruel jaws, and furnished with powerful wings and legs. In the larval state, too, they are very rapacious, living in holes in the ground, and only leaving their heads out; they seize and devour every insect which is unlucky enough to come within their reach.

The *Carabidæ* are a large family of most useful insects, which destroy innumerable destructive larvæ of *Lepidoptera* and other insects. *Calasomas* are particularly active in killing the different species of cut-worms which work such havoc among all spring crops. There are many most valuable and beautiful insects among the *Carabidæ*, the general appearance of which should be known to all, as both in the larval and perfect states they do an incalculable amount of good by keeping down insect enemies.

A very useful family of beetles, because they keep in check the destructive *Aphides*, is known by the name of *Coccinellidæ*, or Lady-birds, and it would be well if the good they do were as well known as they are themselves.

NOXIOUS INSECTS IN ENGLAND AND CANADA.

BY THE REV. C. J. S. BETHUNE, PORT HOPE, ONT.

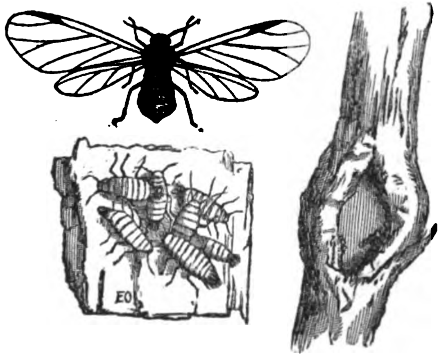
In our last year's Report on Insects, I gave some extracts from Miss E. A. Ormerod's "Notes of Observations of Injurious Insects" in England during the preceding three years, noticing especially those that are familiar to us on this side of the Atlantic. Since the publication of our Report, Miss Ormerod (whose personal acquaintance I had the pleasure of making last summer) has issued her series of "Notes" for 1880, and has published an admirable "Manual of Injurious Insects and Methods of Prevention"—an illustrated volume of nearly 400 pages—that must prove of immense practical value to the farmers and gardeners of Great Britain. I have also recently received from her a copy of a Lecture on Injurious Insects, that she delivered in October last before the professors and students of the Royal Agricultural College at Cirencester. From all these materials supplied by our indefatigable and talented authoress, I propose to give this year an account of some of the most important of the insect enemies that trouble the fruit-growers alike in England and in this country, from which I hope that some useful lessons may be derived for our information and guidance here. Several of the woodcuts with which this paper is illustrated are reproductions of Miss Ormerod's own drawings in her "Manual of Injurious Insects."

1.—THE WOOLLY APHIS OF THE APPLE.

This insect is familiarly known in England by the name of the "American Blight," because it is believed to have been introduced from this continent in the year 1787. Much doubt has been expressed regarding the correctness of this opinion, and for a long time most of our entomologists considered that the European insect was quite a distinct species from the American, and accordingly described the latter under a separate name. The European insect was called *Eriosoma lanigera*, Hausm., and the American, *Eriosoma pyri*, Fitch; now it is agreed on almost all sides that the two insects are identical, though their habits differ very much, and that they should both be known as the Woolly Aphis of the Apple—*Schizoneura lanigera*, Hausm.

In England this creature attacks the branches and twigs of the apple tree, and may be at once "detected by the woolly or cottony growth on the insects, giving the appearance of a white film growing at the bottom of the crevices where a few of them are lurking. Where there are many, the spot appears as if a knot of cotton-wool was sticking to the bough, or even hanging down in pieces several inches in length, ready to be wafted by the first gust of wind, with all the insects in it, to a neighbouring bough."

Fig. 42.



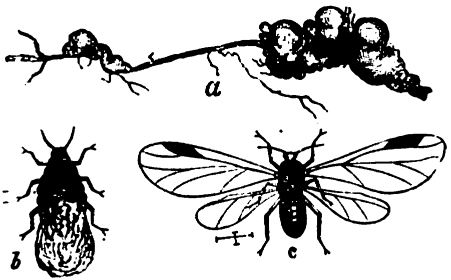
Winged Woolly Aphis, magnified; larvæ much magnified. Apple twig, with the same larvæ nat. size at the lower part of the infested spot.

"The 'Blight' is chiefly to be found in neglected apple orchards. Its headquarters are in crevices in the bark, or in hollows where young bark is pressing forward over the surface where a bough has been cut off, or broken by accident so as to leave a shelter of the old dead bark outside; it may, however, be found on almost every part of the tree into which the Aphis can pierce with its sucker; and the harm caused by the attack is not only from the quantity of sap drawn away from the bark or young shoots, but also from the diseased growth which is thus set up. The bark is at first not much affected by the punctures, but the woody layers beneath become soft, pulpy and swollen. The cells and fibres divide and subdivide, and the bark splits open over the swelling, showing the tissue beneath, which is thus exposed for a fresh attack.

" At the end of summer these watery, swollen growths dry up and die, and thus form deep cracks. With the return of spring (as in other cases of injury) a new growth forms round the dead part, and this soft tissue is ready for the young Aphides. Thus, from the swollen diseased growth partly caused by the Aphides, partly by the natural attempts of the tree to repair damage, a constantly increasing diseased mass arises, which shelters the insects in its crevices and finds food for them in its young hypertrophied formations."

In America, on the other hand, this minute insect works under ground, and produces upon the roots swellings and excrescences of all sorts of shapes and sizes. These materially interfere with the tree's supply of nourishment, and when very numerous occasion its death, especially if the tree be very young. In Canada we are not aware that this insect has been ever observed, though a similar cotton-covered insect is very common on the branches of the alder, nor does it prevail in the more northerly parts of the Northern States, but further south, especially in Southern Illinois and in Pennsylvania, it has been regarded as one of the worst enemies against which the apple trees have to contend. In 1848 it was found to be so abundant on the roots of nursery trees in Chester County, in the latter State, that thousands of young trees had to be thrown away. In the Eastern States it has frequently been found upon the branches of trees above ground, while working at the same time beneath the soil, and on the continent of Europe it has occasionally been found under ground, producing the same swellings upon the root as in America. It is evident, then, that the habits of the insect are governed by the nature of the climate and the character of the soil.

Fig. 43.



a, The swellings on the root; *b*, the larva, with the woolly matter attached to its back; *c*, the perfect winged insect.

This insect, to quote Miss Ormerod's Manual, "may be known at a glance from the common Apple Aphis (*Aphis mali*), which is injurious to the leaves, by the white wool with which it is more or less covered, and from which it takes its name of 'Woolly Aphis,' and an examination of the wings through a magnifying-glass will show that they are differently veined. A strong vein runs down the fore wing near the front edge, and from this three veins turn off towards the hinder edge. The *third* of these veins from the body has only one fork in the American Blight or Woolly Aphis. By this the *Schizoneurinæ*, to which division it belongs, are distinguished from the *Aphidinæ*, which have *two* forks to this vein (as in the Hop Aphis); from the *Pemphiginæ*, which have this third vein *without* a fork (as in Lettuce Aphis); and from *Chermisinæ*, in which this third vein is absent (as in Larch Aphis and Spruce Aphis). This difference in the veins of the fore wings is one clear distinction between the above-mentioned four tribes, of which the great family of *Aphididæ* (which includes all the various kinds commonly known as *Aphides*) are composed.

"The Woolly Aphides are without honey-tubes, and underneath the wool are mostly of a yellowish, reddish, or reddish plum-colour. The winged specimens are described as pitchy between the wings, and green, or with the abdomen of a chocolate-brown. The wingless females may be found packed closely together in the cottony masses, with the pale reddish young moving about amongst them. Winged specimens may be found in July and August."

When attacking the roots, the easiest mode of getting rid of this insect is to drench the infested locality with very hot water, which, though hot enough to destroy the life of the insect, is not injurious to the vegetable organization. In the case of young trees that are being transplanted the pest may be got rid of by dipping the roots in strong soap-suds or tobacco water.

When, however, as in England, the insect affects the branches, "its great harbouring points and the nooks from which the broods come forth in spring and infest the trees, are crevices, especially such as are formed of young bark sheltered under old dead masses. It is, therefore, very important to keep up a clean, healthy, well-trimmed state of the branches, such as will not allow of lurking places, or, if they do exist, will allow of these points of attack being carefully watched. Boughs must be removed in pruning sometimes, and where the Woolly Aphis exists it is certain to try and effect a lodgment under the ring of young bark that grows forward over the stump, but an eye to this matter and a few strong soap-suds brushed on the first bit of wool seen will keep all right. For the same reason the bark should be kept clear of lichens and moss, which form excellent lurking places for the Aphides. In fact, a clean, healthy bark, with a proper allowance of air, light and drainage, is the best of all means of prevention.

"With regard to remedies:—The colonies of insects remain in one place, and soon die if their food is cut off or their breathing pores choked; so that anything which will give such a taint to their harbouring places that they cannot feed, will do good. Soft soap, tar, or in fact anything oily, greasy or sticky that can be well rubbed on, and which by adhering for a time will choke all the Aphides that it touches, will be of use. In the case of an orchard so badly infested that the owner had begun to clear the trees, an application of coal-tar, well rubbed into the infested spots with a hard brush, was tried and succeeded well. The trees were cured of the attack and became healthy. Another observer mentions that his trees on which this was tried were injured and some killed. Probably this different result was from the state of the trees. An application that would be perfectly safe on the blight-tumours of old trees, would be very injurious on young bark that was still living and in an active state."

2.—THE CODLING MOTH—*Carpocapsa pomonella.*

While the English fruit-growers complain of the "American Blight" sent from this side of the Atlantic, we have a much more serious charge against them for sending to us the very destructive "Codling Moth." It is satisfactory to find that this nuisance has not been so injurious during the last few years in Canada as in some previous seasons—though it is always more or less prevalent throughout the country—and that its absence was particularly noteworthy in England during 1880.

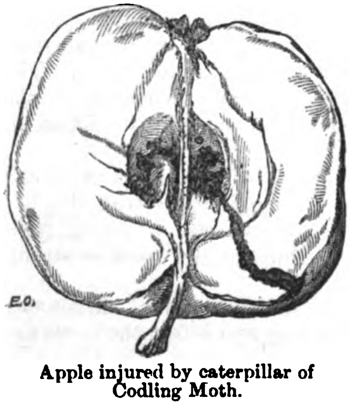
It is not necessary to enter into any detailed account of this insect, as it must be perfectly well known to all our readers, and has been described in our Reports for 1870, 1871 and 1874. I would particularly refer the reader to Mr. Saunders' admirable account of the insect, and the best modes of getting rid of it, in the Report for 1874. As a fresh description, however, is interesting, I shall briefly quote Miss Ormerod's account of the insect:

"The caterpillar of this moth causes what are called 'worm-eaten' apples, which, falling a little before they are ripe, may be known by having a small discoloured spot with a hole in it on the lower side; from this a gnawed passage leads to the middle of the apple, which is commonly nearly filled with dirt.

"The method of attack consists in the moth (when the young apples are beginning to form in the early summer) laying one egg in each fruit, usually in the eye of the apple; from this the caterpillar or maggot hatches, and gnaws its way downwards, taking a direction so as not to hurt the core.

"The caterpillar is about half an inch long, and slightly hairy; whitish, with a brown or black head and dark markings on the next ring, and about eight dots on the others; the food-canal shows as a dark line along the back. As it grows it continues its gallery towards the stem, or the lower side of the apple, where it makes an opening through the rind, and thus is able to throw out the pellets of dirt which could not be got rid of by forcing them upwards through its small entrance-burrow. After this opening is made, it turns back to the middle of the apple, and when nearly full grown pierces the core and feeds only on the pips; and as a result of this injury the apple falls. After this the caterpillar leaves the fruit, crawls up a tree, and, when it has found a convenient

Fig. 44.



Apple injured by caterpillar of Codling Moth.

crevice in the bark, gnaws a little more of it away so as to form a small chamber, where it spins a white web over itself.

"Here in some cases (according to German observations) it turns to the chrysalis immediately, from which the moth comes out in a few days to begin a new attack on the fruit; or (as recorded in this country) it lives still as a caterpillar for several weeks, and then changes to the chrysalis, in which state it usually passes the winter; and from this the moth comes out in the following June.

"The moth is about three-quarters of an inch in the spread of the fore wings. These have a light grey or ashy brown ground, with delicate streaks, and broader markings of a dark tint, giving a kind of damasked appearance; and at the hinder corner is a large spot of a brownish red or gold-colour, with paler markings on it, and a border of coppery or golden colour around it. The hinder wings are blackish."

The following mode of dealing with this pest is so practical, and has been found so serviceable, that I cannot forbear quoting it for the benefit of those readers who have not the opportunity of referring to the Reports for former years. It is taken from Mr. Saunders' paper on the Codling Moth in the Report for 1874:—

"While all other available means tending to the lessening of the numbers of the Codling Moth worms should be unhesitatingly employed, the chief reliance should be placed on the bandages; use strips of cloth—old carpet or sacking where these can be had—but if these materials are not readily procurable, use paper or cotton. Bandages should be from four to eight inches wide, and either fastened with a string or with a tack at the end, and will be all the better if long enough to go twice around the tree; they should be fastened about half-way up the trunk of the tree some time during the latter part of June, and be examined every ten days from the first of July until the last of August, and at least once after the crop is secured. Care must be taken in unwinding the bandages to prevent the worms from escaping by dropping to the ground, which they readily do when the cocoons are thus torn asunder. A common clothes wringer to pass the bandages through, is one of the readiest and surest methods of destroying the worms, and in this way the bandages can be rapidly handled and re-applied. Be careful and scrape the rough bark off the trees, so that the worms may not find suitable hiding places either in descending or ascending the trunk until they reach the bandage. Attend to these instructions regularly and thoroughly, and try and induce all your neighbours to follow your example, and rest assured that good results will attend united effort."

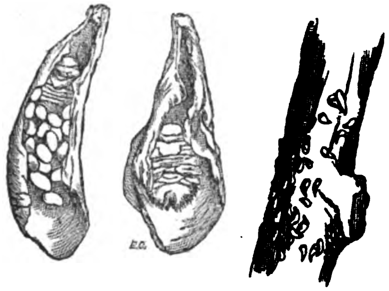
3.—The Oyster-Shell Bark Louse.

This well-known insect is the only other one common to the two countries—except the familiar Apple Aphis (*A. mali*)—which affects the apple to any conspicuous extent. In England it is usually called the "Mussel-Scale;" with us it is familiarly known as the "Oyster-Shell Bark Louse." It has long been termed scientifically *Aspidiotus conchiformis*, Curtis, but is now, in consequence of fuller knowledge of the subject, described under different generic and specific names, as *Mytilaspis pomicorticis*, Riley (*see* his 5th Report, 1873, pages 91-96).

In our Reports for 1870 and 1871 we gave some account of this insect, but have not referred to it since; some description of it, therefore, familiar though it may be, will probably be of interest. The common names of the insect, both English and American, are derived from the shape of the scales produced by the creature, and which may be found adhering in enormous numbers to the bark of neglected apple trees. "The scales are about an eighth of an inch long, dark brown, slightly curved and rounded at one end, much smaller and of a rusty colour at the other, and wrinkled across. They adhere firmly to the bark, and on lifting full-grown specimens the females will be found inside the smaller end of the scale (sheltered by it, *not* fastened to it), the larger end of the scale being filled with fifty or more white oval-shaped eggs. The young scale-insects that hatch from these eggs are very small, flat, and white, furnished with eyes, horns, six legs, and a sucker. These run about with great activity for a few days, but after a while fix themselves and begin to grow, and gradually change in appearance and turn to pupæ.

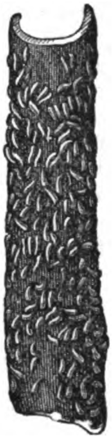
The female resembles a fat fleshy maggot, of a greenish colour, globular, somewhat flattened, and with lines across showing a division into rings, but without articulated limbs; after depositing her eggs she dies, and may be found shrivelled inside the scale."

Fig. 45.



Apple scale; with female; female and eggs, magnified.

Fig. 46.



Infested twig.

Up to 1873 the male insect had not been discovered, but in June and July of that year Mr. Riley reared a number from scales, and thus describes them: "The wings appear whitish, and under a high magnifying power are seen to be covered with infinitesimally small hooks or bristles. The general colour of the body is pale purplish-brown—not unlike the colour of the shield which protected him,—and like other gentry of his family, he has no proboscis (having lost it when shedding the larval skin), but near the place where it naturally would be are a couple of ocular tubercles, which give him the appearance of having four eyes—two above and two below. The hind wings are replaced by two fusiform balancers, which terminate in a long, delicate hook, and which hold and give strength to the front wings, which are spatulate in form and traversed with but two veins. Frail and delicate as these little beings appear, they are yet possessed of wonderful nerve-force and wing-power; for the few days of life allotted to them are days of great activity, and in the breeding-jar they keep up an almost constant wing-vibration, and are never at rest except when the temperature is unusually low."

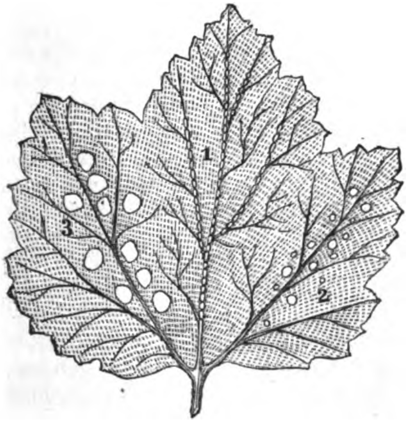
As regards prevention and remedies for this insect, Miss Ormerod mentions, among other plans, that "Scale may be removed at any time of the year, but the best season for destroying it or applying dressings is in spring, so as to clear it away before the young insects—which creep out in May from under the old dead shells—have appeared, to begin the new attack. It may be removed by thoroughly moistening the surface of the infested bark with lathers of any kind of soap (or any dressing that may be preferred), and then scraping the surface with a blunt knife, or rubbing it with pieces of coarse canvas, or well brushing it, so as to clear off the scale without hurting the bark. Scraping with a blunt knife is a good plan, as in this way the scales, moss, and everything on the surface are mixed up in a plaster with the soapy lather and got thoroughly rid of together. If brushing is preferred, good drenchings of soap and water, or of dressings poisonous to the scale, should be given in addition to the first thorough moistening, so as to wash down or kill all that may have only been disturbed or be lodged in crevices. Soft soap or common coarse household soap are useful for this purpose."

Mr. Riley gives the following advice on the subject:—"The importance of critical examination, before planting, of all young trees and scions, or of applying some simple remedy when the young lice are hatching, cannot be too strongly urged; and, as a rule which will hold very generally true, it may be stated that the young begin to hatch just about the time the blossom falls and the fruit begins to set. Let those who prefer to work toward eradicating the pest in winter-time (as many no doubt will, on account of the leafless state of the trees and the greater leisure which most fruit-growers have at that season), vigorously prune and scrape the infested trees, and afterwards apply some of the oily applications usually recommended. As a remedy not previously named, I would mention linseed-oil, which has been used with marked and beneficial results. Many persons have been deterred from using greasy or oily substances on their trees from a fear of evil consequences resulting to the trees; but there is nothing more certain than that judiciously applied in early spring, after the sap begins to flow, these applications do not injure trees, while they are effectual, more especially when applied at such season or during thawing weather, in killing the eggs under the scales, the oily particles being absorbed through and under the scales and destroying the eggs as soon as touched." Crude petroleum I have known to be employed with excellent effect, but of course care must be taken not to apply it to tender shoots or young branches.

4.—THE GOOSEBERRY AND CURRANT SAWFLY—*Nematus ribesii*, Curtis.

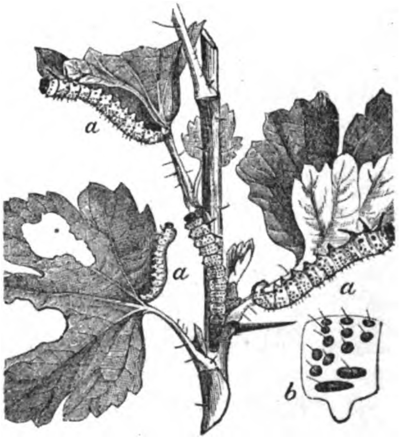
This is another very familiar pest on both sides of the Atlantic, and is only too well known to gardeners, both here in and in England, from the havoc its caterpillars cause every year to the leaves of currant and gooseberry bushes. It has been fully described in our Reports for 1871, 1874 and 1875, by Mr. Saunders.

Fig. 47.



A leaf with eggs on the under side.

Fig. 48.

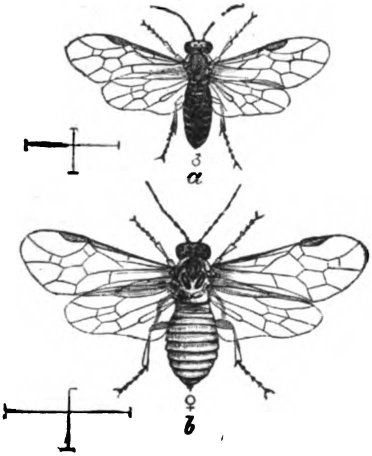


Caterpillars of the Sawfly.

The parent sawflies appear, in this country, about the end of April or beginning of May, and lay their eggs on the under side of the leaves of the currant and gooseberry almost immediately after they expand in the spring. The eggs are deposited in rows, usually along the mid-rib and larger ribs or veins of the leaf, as shown in the figure above; the female generally selects for the purpose leaves that are low down in the middle of the bush. The larvæ hatch out in about a week, and begin at once to feed by eating small round holes in the softer parts of the leaf; as many as sixty or seventy have sometimes been found on a single leaf. The attack of the caterpillars may be discovered at once by the appearance of a number of small holes eaten through the leaves. Each brood feeds on the leaf on which it was hatched until it is completely stripped of all that is eatable, and nothing but the hard ribs remain; the individuals then scatter over the bush, half a dozen or more being found on a single leaf, and in a bad attack soon completely denude the bush of its foliage.

"These grubs," to quote Miss Ormerod, "are of a bluish-green, with black head, feet, tail, and also black spots on each segment, and with a yellowish space just behind

Fig. 49.



a, Male sawfly; b, the female.

the head and another just before the tail. When full grown, and after changing the skin for the last time, these yellow patches still remain, but they are otherwise of a delicate pale green, with sometimes two little black dots on the head, and are about three-quarters of an inch in length. After the operation of casting the skin they rest awhile, and then crawl down the stem of the bush or drop from a bough, and at once begin to bury themselves. When deep enough, which may be from two to eight inches, according to the nature of the soil, they form a cocoon of a gummy secretion, in which they turn to chrysalids. This takes place in about three weeks during summer; in the case of the late broods the grub remains unchanged in the cocoon during winter, and does not turn to the chrysalis till spring, in time for the gooseberry sawfly to make its appearance as the gooseberry and currant bushes are coming into leaf.

"The sawfly is of the shape figured above, and of the length marked by the straight lines; the head and body between the wings are ochre-colour or yellow, variously marked with black; abdomen yellow or orange; legs yellow, with brown or black tips to the feet and hinder shanks; horns brown or black. The four wings are transparent and irridescent.

"An excellent and effectual method of preventing attack in the coming season is to remove the soil from beneath the bushes to the depth of a few inches early in spring, and give a good sprinkling of lime; by this means the caterpillars which winter in the ground are completely cleared away. A slightly different method, but thoroughly successful, is to remove the surface soil below the bushes in winter, dig a deep hole, and bury the whole of the removed soil, cocoons and all (so deeply as to ensure having no further mischief from them), and replace the earth removed with manure and the soil dug from the hole.

"This complete removal of the soil with the cocoons is quite worth while wherever the gooseberry caterpillar is prevalent, and a layer of unslacked lime, well mixed with the soil as deep as the cocoons are, would be highly beneficial in case of the surface-soil not being removed. Gas-lime also would be of service, well sprinkled on the surface, if fresh, or lightly pricked into the surface-soil beneath the bushes after it had been aired for a few weeks, taking care not to lay it against the stem.

"When the caterpillars appear on the bushes, it is of great importance to attend to them at once; whilst still very young two or three dozen may be found on one leaf and got rid of together, which in a few days would have spread themselves over the bush. This early stage of attack may be known by the leaves appearing as if riddled with dust-shot. At a later stage thorough hand-picking, or shaking the bushes so as to make the caterpillar fall, is of service. If the caterpillars are allowed to drop on the ground, they should be crushed with the foot, or with the back of the spade; but a surer plan, with little more trouble, is to spread cloths or put some tarred boards under the trees, and thus collect and kill them."

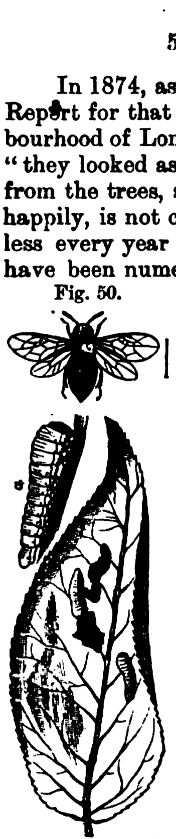
The plan of removing the surface-soil from beneath the bushes, which is new to us, has been adopted with great success during the last twenty years (Miss Ormerod records in her Report for 1880) at Oxenford Castle. The soil is annually removed in winter, a deep hole is dug in some part of the garden, and in this the removed soil, with whatever may be in it, is buried. The soil under the bushes is replaced by that out of the hole, with the addition of some manure. It is important that the hole should be *deep*, as if there was only a light covering many of the larvæ and pupæ would not be the worse for being moved, and would emerge in the spring to inflict as much damage as usual.

In this country we have no doubt that our small-fruit-growers will adhere to the use of powdered white hellebore, which has proved so effective in the past, is so easy to apply, and from the use of which no evil consequences have ever resulted to our knowledge.

5.—The Pear-tree Slug-worm.—*Selandria cerasi*, Curtis.

In 1874, as Mr. Saunders relates in his very complete account of this insect in our Report for that year, the slug-worms were unusually abundant on pear-trees in the neighbourhood of London, Ontario, in many cases destroying the foliage so thoroughly, that "they looked as if they had been scorched by a fire, every leaf in some instances dropping from the trees, so that for a time they were as bare as in mid-winter." Such a visitation, happily, is not common; still these disgusting creatures are usually to be found more or less every year on our pear and cherry trees. In Scotland, in 1880, they appear to have been numerous and destructive both at Dalkeith and Dumfries.

Fig. 50.



A leaf attacked by slug-worms. *a*, Magnified specimen.

The slug-worms feed on the upper surface of the leaves of the pear and cherry, eating away the whole of the soft substance of the leaf, so that the veins and the skin of the lower side are all that remain. They may be recognized, when at their work of destruction, by their blackish or bottle-green colour, together with their peculiar shape, and the covering of slime or moisture exuding from their skin, which gives the worms the appearance of a slug, or rather that of a lump of wet black dirt fallen on the leaf and run together at one end. They may be at once recognized also, when very numerous, by their disgusting and sickening smell.

Miss Ormerod relates that, in England, "the sawflies appear in July, and deposit their eggs on or in the upper side of the leaf; these eggs are oval, and hatch in a few days. The larvæ are of the lumpy shape figured above, much the largest at the back of the head; they are furnished with ten pairs of feet—that is, one pair on each of the three segments next to the head, and a pair of sucker-feet on each of the other segments, excepting on the fourth from the head and the tail segment, which are footless. When feeding, they keep the end of the tail a little turned up. In four or five weeks these slug-worms arrive at their full growth, which is about half an inch in length, cast their dark bottle-green skins, and appear as yellow or buff caterpillars, free from all shine, and transversely wrinkled, instead of being perfectly smooth. In the instance noted this happened at the beginning of October, and the caterpillars shortly after left the leaves and went down into the ground, where they spun an oval brown silken cocoon covered outside with earth, from which the sawflies came up in July in the following year. The female fly is of a shining black, tinged with violet; the wings often stained with black, with dark nerves, and a dark brown mark (the stigma) along the fore edge. The four anterior legs are brownish ochre, and the others are more or less of that colour, but generally much darker; and the thighs, or at least the base, are pitch colour."

In Canada these saw flies are double-brooded. The winged flies appear in May; the eggs are deposited singly in little slits cut for them in the skin of the leaf by the ovipositor of the female, and these produce a brood, coming out in the perfect state in July; from which a second brood arises, which is full grown in September or October. These remain in the ground during the winter, and for the most part appear (as above mentioned) fully developed in the following May; but some remain in the ground unchanged till the following year.

As a prevention, Miss Omerod recommends the same plan as in the case of the gooseberry saw fly, viz., to skim off the surface soil beneath the infested trees, and get rid of it so as to destroy the contents. The cocoons are stated to be at a depth of from one to three or four inches below the surface, according to the nature of the soil. She suggests as remedies, (1) Shaking the flies down from the trees early in the morning or late in the evening (or at whatever time it was found they were collected on the leafage), and catching them on boards covered with wet tar, or cloths, taking care that they were destroyed before they could escape; (2) Dusting with caustic lime two or three times; (3) Syringing with tobacco water, strong soapsuds, etc.; and (4) Showering the trees with a solution of hellebore.

A most effective plan for getting rid of the pest is thus described by W. Saunders (Report for 1874):

"On the 29th of July, when going through the orchards in the afternoon, the new brood of flies were found in the greatest abundance, resting on the young leaves, or on those portions of green which still remained on the leaves partially eaten by the last brood; they were congregated, however, more especially on those trees where green leaves were most abundant. On disturbing them they would fall to the ground with the antennæ bent under their bodies, and the head bent forward. On half a dozen trees we caught about 60 specimens, and might have taken hundreds, they were so thickly spread that in many instances there were two and three on a single leaf. By the last week in August, the second brood of slugs were hatched; some very tiny creatures, others by this time half grown. Now, those trees which had previously escaped were all more or less covered, and would no doubt soon have been stripped, had not some measures been at once taken to destroy them. A raised platform was rigged up in a one horse cart in which was placed a barrel of water in which a pound of powdered hellebore had been mixed, and from the elevated stand this mixture was showered lightly on the trees from the rose of a watering-pot. It was astonishing how quickly the trees were cleaned, scarcely one could be found on a tree the morning after the application had been made, and ten pounds of hellebore with five or six days work of man and horse served to go over the whole ground, the work being completed in much less time than we had supposed it could."

With the exception of some species of Aphis, or Plant Lice, which affect many kinds of trees, the foregoing are the only species of insects attacking fruit trees that appear to be common to this country and England. There are, however, some species very similar to well-known pests here that cause trouble and anxiety to the old country gardener. Among these we may mention

6. THE LACKEY MOTH—*Clisiocampa neustria*, Curtis,

which is very closely allied in appearance and habits to our familiar "Tent Caterpillars" (*Clisiocampa Americana* and *Sylvatica*), as may be learnt from the following description, which would almost answer for our own species:—

"The caterpillars of the Lackey Moth are injurious to oak, elm, birch, etc, but are especially pests when they attack the apple. The eggs are to be found in winter and spring, laid on naked twigs, in compact spirally-arranged rings about half an inch long. From these eggs small black hairy caterpillars hatch about the beginning of May, and immediately spin a web over themselves, which they enlarge from time to time as needed for their accommodation. In these webs they live in companies of from fifty to two hundred, and from them the caterpillars go out to feed on the leaves, returning for shelter in wet weather or at night. When alarmed, they all let themselves down by threads, either to the ground, or else, after hanging in the air till the alarm is past, they go up again by their threads to the tree.

"When full fed, which is about midsummer, they are an inch and a-half in length, and hairy; of a bluish-grey colour, marked with two black eye-like spots on the head, two black spots with a scarlet space between them on the next ring, and three scarlet stripes on each side and a white one on the back, all bordered with black along the rest of the caterpillar. At this stage the caterpillars no longer live in companies, but each finds some sheltered spot, between leaves, in hedges, beneath the bars of railings, under roofs of sheds, or even on the tops of walls, where it spins a sulphur-coloured silken cocoon, mixed with sulphur-coloured powder and with hairs from the skin woven into it, from which the moths hatch in July.

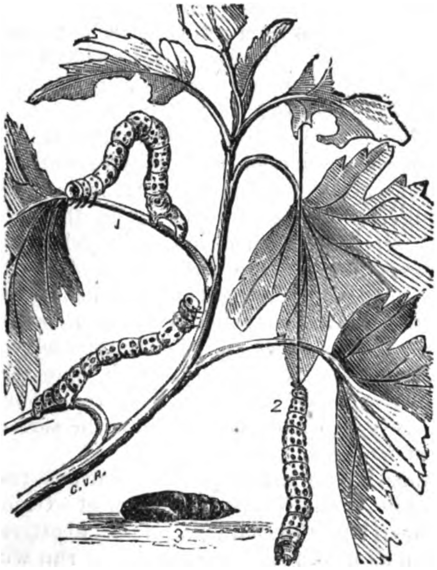
"The moths are variable in colouring, mostly with rusty-fox or ochrey markings, but some have the fore wings of a red-brown, with two pale ochreous streaks; others yellowish, with dark brown bars; and others are variously tinted: the hinder wings are reddish-brown. It is stated that the moths, and especially the females, seldom fly, but remain concealed by day under leaves and in long grass, and come out at night.

"The caterpillars seldom do the enormous quantity of mischief with us in England that they are noted as causing in France, where, according to the old law, it was compulsory on proprietors to have the webs on the shoots cut off with shears and destroyed, in consequence of the ravages of the caterpillars (if left unchecked), ruining the apple leafage over an extent of miles of country."

7. The Magpie Moth of the Gooseberry—*Abraxas grossulariata*, Stephens,

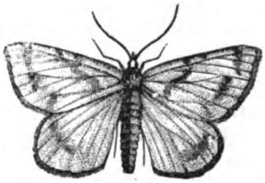
is another English insect that may be mentioned on account of its resemblance in its caterpillar state to our Geometer Currant and Gooseberry worm (*Abraxas ribearia*, Fitch), represented in the annexed wood-cut, which will almost serve for its English relative, though the moths are totally different in their markings.

Fig. 51.



1 and 2, Caterpillars; 3, chrysalis of *Abraxas ribearia.*

Fig 52.



Moth of *Abraxas ribearia.*

The English insect—the Magpie Moth—is thus described:—"The caterpillars of this Moth are not so injurious as those of the Gooseberry Sawfly, but they occasionally occur in sufficient numbers to strip the bushes of their leaves. They frequent the Gooseberry and the Black and Red Currant, and also the Common Sloe, or Blackthorn. The egg—one or more—is laid on the leaves towards the end of summer; the caterpillars hatch in September, and feed for a short time; and then either fall to the ground with the fall of the leaves in autumn, and remain sheltered amongst them for the winter, or they spin the edges of a leaf together, which they have previously fastened by threads to the bough, and inside this protection remain until the return of spring. When the new leafage unfolds, the caterpillars come out and feed till May or the beginning of June, when they change to chrysalids. The caterpillar is one of the kind known as "loopers," from the peculiar looped shape it draws itself up into when alarmed (see fig.); the head is black; body cream-coloured, with a reddish-orange stripe along the sides; the whole of the second ring, and the under side of the third and fourth, and of the four nearest the tail, are also reddish-orange. A row of large irregular black spots runs along the middle of the back. When full fed it spins a light transparent cocoon attached to twigs, or palings, or in crevices of walls; and in this it changes to a chrysalis, yellow at first, but afterwards shining black, with orange-coloured rings.

"The Moth is very variable in appearance; commonly it has a black head, yellow body between the wings, with a large black spot in the middle; the abdomen also yellow, with five rows of black spots. The wings are white, spotted with black, and the fore-wings have a yellow blotch at the base and a yellow band across them. There are, however, almost endless varieties of markings, from black of different shades, to white; some have the upper half of the wing white and the lower black, or the reverse; some have the ground colour of the wing (instead of merely a band) yellow; and in some cases the hinder wings are striped with black. The Moths appear about midsummer or rather later."

8. THE WINTER MOTH—*Cheimatobia brumata*, Stephens.

This insect resembles very much our species of canker worms (*Anisopteryx vernata* and *Pometaria*), which have deen described by Mr. Saunders in the Report for 1875:

"The caterpillars of this moth are injurious to almost all fruit and forest trees. They feed on the young buds and leaves of the plum, apple, pear, elm, lime, willow, hawthorn, and many others, and occur at times in such great numbers as to cause a very serious amount of damage. The moths (known as "Winter Moths," from the season of their appearance), come out about the end of October. During November and December the females, which have only abortive wings, creep up the trees and lay their eggs on the leaf or flower buds, on the twigs, or in crevices of the bark.

"The eggs are greenish at first, and gradually change to brown or red. They are very minute, and very numerous (a single moth laying as many as two hundred), and they hatch about the beginning of April. The newly-hatched caterpillars are only about as thick as a horse-hair, greyish in colour, and may be seen swinging in the air at the end of their threads; when full-grown they are half an inch long, of a yellowish-green, with pale green head, black or blue line down the middle of the back, and whitish lines on each side. When walking they form a kind of upright loop, whence the name "Looper caterpillars." They feed first on the young unopened buds, and, as the leaves expand, they draw two or three together with their webs, and shelter themselves within when not feeding. When full-fed, towards the end of May (by which time they have often caused great damage), they let themselves down by a thread to the ground, bury themselves, and turn to chrysalids about two or three inches below the surface, from which the moths come up towards the end of October.

"The male moths have the fore wings of an ash-grey, with various transverse markings, and the hind wings of a greyish-white. The females have a most extraordinary appearance, from the great size of the abdomen and the small size of the abortive wings; they have no powers of flight, but fall down as if dead when alarmed, or run with some speed to hide themselves. In November the males may be seen, after sunset, flying from tree to tree, and the females creeping up the stems to deposit their eggs."

The same method of prevention is recommended in England as in this country, viz.: to encircle the trunk of the tree with some obstacle which the female cannot pass, and so prevent it from depositing its eggs upon the foliage.

9. THE GREEN ROSE CHAFER—*Cetonia Aurata*, Curtis.

This is the only other English insect injurious to fruit that remains to be mentioned, as it resembles in its habits our common May-beetle, or "June-bug" (*Lachnosterna fusca*), which often grievously injures the roots of strawberry-plants in its larval state, when it is familiarly known as the "White Grub." Both belong to the Scarabaeidae, or Digger family of beetles, described by Mr. Fletcher in the Report for 1879.

Miss Omerod thus describes the English insect:

"This chafer is injurious both in the larval and perfect state. In the first—that is, as a grub—it feeds on the roots of strawberries, grass, and other plants; as a beetle it frequents many kind of flowers, including the rose, from which it takes one of its names; but is more especially injurious by its attacks on strawberry-blossoms, and to the flowers of turnips left for seed, where it eats off the anthers from the stamens and thus renders the flowers abortive."

"The eggs are laid in the ground, where the maggots hatch and feed for two or three years. When full-grown they are upwards of an inch and a half in length, thick and fleshy, of a whitish colour, with an ochreous head armed with strong jaws; the pairs of short feet are of a rusty ochreous colour, and the hinder portion of the grub or maggot is enlarged, curved towards the head, and of a lead colour. These grubs are much like those of the cockchafer, but are distinguished by having a horny rusty spot on each side of the segment behind the head, and by the body being clothed with transverse rows of rusty-coloured hairs; whereas the grub of the cockchafer is almost hairless, and is without the rusty spots.

"When full-fed they make earth-cases 'as large as a walnut,' at a considerable depth beneath the surface, which are smooth inside, but covered outside with pellets of soil which have passed through their own bodies; and in these cocoons they turn to ochre-coloured pupæ.

"The Chafers, which sometimes appear as early as the beginning of May, are of a rich metallic golden-green above, with white or ochreous spots or streaks looking like cracks running across the bright green of the wing-cases; beneath they are coppery, with a rose-coloured tint. The horns are much like those of the cockchafer, excepting that the club is formed of only three leaves. Beneath the wing-cases are large brown membranous wings, by means of which, when they have finished whatever is eatable in one place, they can fly with ease to another; it may be a strawberry-bed, or may be field of turnips in blossom; and thus, if the weather is fine, they continue to attack whatever may attract them throughout the summer; in wet weather they die earlier in the season."

4970
May 20. 1883

CAMBRIDGE
MASS.

REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF ONTARIO,

FOR THE YEAR 1882.

Printed by Order of the Legislative Assembly.

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1883.

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THIRTEENTH ANNUAL REPORT

OF THE

ENTOMOLOGICAL SOCIETY

OF

ONTARIO,

INCLUDING REPORTS ON SOME OF THE NOXIOUS, BENEFICIAL AND OTHER INSECTS OF THE PROVINCE.

PREPARED FOR THE HONOURABLE THE COMMISSIONER OF AGRICULTURE BY THE OFFICERS AND MEMBERS OF THE SOCIETY.

1882.

To the Honourable the Commissioner of Agriculture:

SIR,—I beg to submit to you, herewith, the Annual Report of the Entomological Society of Ontario, prepared in compliance with the provisions of our Act of Incorporation.

The audited Financial Statement is submitted, as well as the transactions of the annual meeting, which was held this year in the City of Montreal, on August 24th. The Society is greatly indebted to your courtesy in enabling them to meet in Montreal, as an opportunity was thus afforded of obtaining the presence of a large number of scientists, who were attending the session there being held, of the American Association for the Advancement of Science.

I have, also, the honour to submit, herewith, for your approval, illustrated reports of various insects, which have been prepared by members of the Society.

In order to make these reports more useful and their information more accessible to those interested in them, the Society has thought it advisable to prepare an index of the whole series that have been issued by the Department, and I trust that it will meet with your approval. It will bear good evidence, that, through the Department, a vast amount of practical information has been given to the public respecting the habits and life history of the various insect friends and foes that abound in every part of the Province.

I am glad to be able to report that our Society still maintains the publication of the *Canadian Entomologist.*

During the year an application was made to the members of the Society by the Minister of Marine and Fisheries of the Dominion to furnish specimens, illustrating the natural history of insects serving as food for fishes, or which are destroyers of spawn, it being desired to exhibit them at the great International Fisheries exhibition to be held in London, England, in 1883.

The Society cheerfully complied with the request, and it is intended to prepare some forty cases as a Canadian exhibit.

I have the honour, sir, to remain,
Your obedient servant,
EDMUND BAYNES-REED,
Secretary-Treasurer.

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The annual meeting was held in the rooms of the Natural History Society, Montreal, on Thursday, August 24, 1882, at 3 o'clock p.m.

The President, Mr. Wm. Saunders, of London, Ont., in the chair.

Present: H. F. Bassett, Waterbury, Conn.; Rev. C. J. S. Bethune, M.A., Port Hope; G. J. Bowles, Vice-President, Montreal; F. B. Caulfield, Montreal; Prof. J. H. Comstock, Cornell University, Ithaca, N.Y.; Prof. A. J. Cook, Agric. College, Lansing, Mich.; Wm. Couper, Montreal; T. Craig, Montreal; J. M. Denton, London; C. R. Dodge, Washington, D.C.; Prof. C. H. Fernald, State Coll., Orono, Maine; C. Fish, Brunswick, Maine; Jas. Fletcher, Ottawa; Rev. F. W. Fyles, Cowansville, P.Q.; Prof. H. A. Hagen, Mus. Comp. Zool., Cambridge, Mass.; W. H. Harrington, Ottawa; Prof. S. Henshaw, Boston, Mass.; Dr. P. R. Hoy, Rachine, Wis.; J. G. Jack, Chateauguay Basin, P.Q.; Dr. H. S. Jewett, Dayton, Ohio; Prof. J. A. Lintner, State Entomologist, Albany, N.Y.; H. H. Lyman, Montreal; B. Pickman Mann, Assist. Entomologist, Agricul. Dept., Washington, D.C.; Prof. C. V. Riley, Entomologist Agric. Dept., Washington, D.C.; Wm. Shaw, Montreal; E. D. Winble, Montreal; C. D. Zimmerman, Buffalo, N.Y.; E. Baynes-Reed, Sec.-Treas., London, and others.

The minutes of the previous meeting were confirmed, the reading being dispensed with as they had been printed and sent to the members.

The President then addressed a few words of cordial welcome to the members present.

The report of the Council and the financial statement of the Sec.-Treas. for the past year were then read, and, on motion, adopted.

REPORT OF THE COUNCIL FOR 1882.

In presenting their Annual Report, the Council desire to give some explanation as to the time and place of holding this annual meeting. Knowing that it had been determined that the American Association for the Advancement of Science would meet this year in Montreal, it seemed to your Council to be desirable to hold the annual session of the Entomological Society of Ontario at the same time and place.

The necessary application was accordingly made to the Hon. S. C. Wood, the Commissioner of Agriculture for the Province of Ontario, to sanction such an arrangement, it being pointed out to him that the presence of so many distinguished Entomologists from the United States would have a most beneficial effect upon the meeting, and that the interests of the great agricultural community for whose welfare this Society is chiefly maintained would be promoted by the intercourse and exchange of thoughtful and useful suggestions from so large a gathering of practical entomologists, with this request the Commissioner most cheerfully and promptly complied.

The Council, moreover, felt that the holding of the annual meeting of the Entomological Society of Ontario, in the ancient City of Montreal, was the more desired on account of the presence there of those energetic entomologists through whose unwearied efforts the Montreal Branch of our Society has been so well sustained, and whose Ninth Annual Report, to be submitted to you to-day, affords additional evidence of zeal and interest in Entomology.

The Council are pleased to be able to report that the progress of the Society still continues.

After thirteen years of existence, the *Canadian Entomologist* may now be regarded as firmly established, and the Council trust that it may continue to receive in the future the same amount of valuable additions to our store of Entomological knowledge which in past years have given it a not unworthy place as one of the chief contributors to the Entomological Literature of America.

The demand from various European Scientific Societies, and others, for complete sets of the *Canadian Entomologist*, have rendered it necessary to reprint the first and second volumes. The Society can now, therefore, furnish copies of all the volumes.

During the last session of the Dominion Parliament the Council endeavoured to obtain for Scientific Societies the admission of books for their Libraries free of duty; in this they were disappointed, but they hope at the next session to be more successful, being convinced that it is an effort in the right direction, and that its success would prove a great benefit to the various Scientific Societies of the Dominion.

The Annual Reports of our Societies are being continued, and the Ontario Government distributes large numbers of them.

In the past year the Council have caused visits to be made to various places where insects were reported to be damaging crops, etc. Inquiry was made as to amount of injury being caused, and suggested practical remedies.

The Library of the Society is increasing. It is hoped that the catalogue—the printing of which has from various reasons been delayed—will shortly be issued to the members. The Council are glad to be able to report that they have secured a complete set of the valuable publications of Prof. Townend Glover, of Washington, D. C.

It is with regret that the Council learn that the sub-section of Entomology of the American Association for the Advancement of Science has been merged in the important section of Biology. The meetings of the sub-section in past years was a source of gratification to all attending them, and afforded excellent opportunities for furthering Entomological Science.

In the wide region, embraced by Section F., it is to be feared that the special interests of Entomology will suffer in some degree, and the Council would respectfully suggest that an effort be made to revive the Entomological Club, so that the members attending the meeting of the Association, while doing all they can to sustain Entomology in Section F. by reading of papers, etc., may have ample time for that full and free discussion of the details of our work which is so important to the progress of our special branch of Natural History.

The audited Report of our finances for the past year will be submitted to you as usual.

On behalf of the Council.

E. Baynes Reed,

Montreal, P. Q., Aug. 24th, 1882. *Secretary-Treasurer.*

ANNUAL STATEMENT OF THE SECRETARY-TREASURER OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO, FOR THE YEAR ENDING AUGUST 19TH, 1882.

Receipts.

Balance from previous year, 1881	$ 73 92
Members' fees, sale of *Entomologist*, etc	253 48
Government grant, 1882	1000 00
Collector's material: pins, cork, etc...	38 36
Interest on Bank account	9 01
Engraving—received for electrotypes of cuts	3 25
	$1,378 02

Disbursements.

Canadian Entomologist: printing, paper, stationery, etc	$390 32
Library	317 17
Expenses of Report for 1881, including engraving, electrotypes and woodcuts	291 95
Annual vote to Editor and Secretary-Treasurer	175 00
Rent...	80 00
Insurance	12 00
Sundries: postage, etc	55 60
Balance	55 98
	$1,378 02

We certify that we have examined the above with books and vouchers, and found the same correct. Balance in Bank and Secretary's hands, fifty-five dollars and ninety-eight cents.

CHARLES CHAPMAN, } *Auditors.*
H. B. BOCK, }

Entomological Society Rooms, London, Ontario.
August 19th, 1882.

The report of the Montreal Branch was submitted and read to the meeting:—

MONTREAL BRANCH OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The Ninth Annual General Meeting of this Branch was held on Tuesday, 16th May, 1882, at eight o'clock p.m., at the residence of H. H. Lyman, Esq., President.

The following report was read and adopted:—

REPORT.

In presenting their Ninth Annual Report, your Council would congratulate the members on the continued prosperity of the Society, and the undiminished interest manifested by all in the study of our chosen branch of Natural Science.

We have held eight pleasant and instructive meetings during the year and three new members have been added to our list. We have, however, lost by resignation an old and valued member, Mr. Robert Jack, of Chateauguay Basin, who has always felt a deep interest in our success, and manifested it in many ways.

Six original papers have been read during the year, as follows:—

1. Notes on some Species of *Hymenoptera* occurring at Montreal, by F. B. Caulfield.
2. On Instinct in Insects, by G. J. Bowles.
3. The Pickled Fruit Fly (*Drosophila ampelophila*), Loew, by G. J. Bowles.
4. On the *Genera Hepialus* and *Sthenopis* in Canada, by G. J. Bowles.
5. Notes on the *Genus Callimorpha* in the Museums of Boston, by H. H. Lyman.
6. List of *Lepidoptera* collected by Dr. Bell, of the Geological Survey, in 1881, at Sault Ste. Marie, etc., by H. H. Lyman.

Also a selected paper by H. H. Lyman, entitled "Insects as Medicine."

Our library has been increased by a valuable donation of books, reports, etc., from the parent Society in London, Ontario, for which the cordial thanks of this Branch are justly due. We have also received "Psyche" for the current year, but have not expended any of the funds in books.

The whole respectfully submitted,

H. H. Lyman,
President.

Montreal, 16th May, 1882.

The following were then elected to office for the ensuing year:—

H. H. Lyman, President (re-elected); W. Couper, Vice-President (re-elected); G. J. Bowles, Secretary and Curator (re-elected). Council—F. B. Caulfield, J. G. Jack, and E. D. Wintle.

Adjourned.

Geo. Jno. Bowles,
Secretary.

The election of officers then took place, when the following gentlemen were duly elected:

President, Wm. Saunders, London; Vice-President, G. J. Bowles, Montreal; Secretary-Treasurer and Librarian, E. Baynes Reed, London. Council—Rev. C. J. S. Bethune, Port Hope; J. Fletcher, Ottawa; Rev. F. W. Fyles, Cowansville; W. Couper, Montreal; J. M. Denton, London; J. Alston Moffatt, Hamilton; W. H. Harrington, Ottawa. Editor of *Canadian Entomologist,* Wm. Saunders. Editing Committee—Rev. C. J. S. Bethune, J. M. Denton, E. B. Reed. Auditors—H. B. Bock and C. Chapman, London.

The President then delivered his annual address, for which he was unanimously tendered a vote of thanks, together with a request to publish it in the *Canadian Entomologist.*

ANNUAL ADDRESS OF THE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

Gentlemen,—For the first time in the history of our Society, we meet within the limits of the Province of Quebec. Although belonging to Ontario, and sustained in our work mainly by the liberal aid granted us by the Government of Ontario, our sphere of usefulness extends throughout the length and breadth of this great Dominion, and also across the lines into the United States. We have long had an active Branch of our Society in Montreal, comprising members who have materially aided in the advancement of Entomological Science, and now at this particular juncture, when so large a body of distinguished scientists were to honour Montreal with their presence, and among them many noted Entomologists, no time, it was thought, could be more opportune than this in which to hold the Annual Meeting of our Society, and by the kind permission of the Hon. S. C. Wood, Commissioner of Agriculture for the Province of Ontario, we are privileged to meet here on this occasion.

During the past season that dreaded pest, the Hessian Fly, has prevailed to a considerable extent in Ontario. My attention was first called to it this season during the last week in July, when the grain was ripening. On visiting the wheat fields in the vicinity of London, I found the insect very prevalent, and in some instances I believe the injury to the crop must have been fully twenty per cent. The affected stalks were lying on the ground, and the grain in the heads imperfectly developed; on pulling these they would often break at the point where the insect had been at work, that is, about the base of the first or second joint. On examining the affected stalks, the insect was found to be in what is known as the puparium or flax-seed state, from the resemblance which it bears in this condition to a grain of flax-seed. The attention of farmers was drawn to the depredations of the insect by a communication to the press, and information sought as to the extent of the evil. From letters received from various sections of the Province, it is evident that the insect prevails over an extended area, and that the sum total of the loss entailed on the agricultural community in Ontario from this cause would figure up to a large sum, probably hundreds of thousands of dollars. In 1876 and 1877 this insect appeared in considerable force, and seriously injured the wheat crop in many parts of our Province, but since that time we have enjoyed comparative immunity from it until now.

The Hessian Fly belongs to the order of *Diptera*, or two-winged insects, and is about one-tenth of an inch long, with dusky transparent wings fringed with fine hairs There are two broods during the year. The flies which appear in the autumn, deposit their eggs, from one to twenty or more, on a plant in the cavities between the ridges of the blades or between the stalk and sheathing base near the roots of the young fall wheat. These hatch in four or five days into tiny grubs, soft, smooth and shining, which work their way down the leaf to the base of the sheath, about the crown of the root. Here they fasten themselves head downwards to the tender stalk, live upon the sap, and gradually become imbedded more or less in the substance of the stalk. When once located the larva moves no more, but growing rapidly, soon becomes plump, and when mature is about one-sixth of an inch long, greenish, and semi-transparent; before long it changes to the flax-seed state, in which condition it remains throughout the winter. Early in spring the flies are produced, which deposit their eggs about the first or second joint of the stalk, where they pass through their several stages, assuming the flax-seed state a few weeks before the wheat ripens, from which the flies hatch in August and September.

The effects of the presence of this insect in the young fall wheat is to weaken the plants, which become unhealthy, turn yellow and sometimes die. Often there is a gall-like swelling or enlargement of the stalk near the base, in and about which the insects will be found. The unhealthy plants contrast strongly with the rich green of the vigorous uninjured grain. The late brood may be easily found by separating the leaf from the stalk of the young wheat in October or November; the early brood, as already stated, in the reclining stalks, which, when very numerous, makes the wheat appear as if "lodged" in patches.

Various measures have been recommended for the destruction of this insect. Some have advised the immediate threshing of the wheat and the burning of the straw; but since most of the insects are left in the stubble this would be labour lost. Tearing up the stubble with a cultivator immediately after harvest, and raking it into heaps and burning it, is another suggestion; but this involves much labour at a time when the farmer is extremely busy, and during the process many of the insects would necessarily be shaken out of the stalks and escape. Burning the stubble in the field where practicable is a much wiser course; but it must be borne in mind that this process involves the destruction of the friendly parasites which feed upon the enemy, as well as the enemy itself. In my address to you two years ago, I expressed the opinion that we were almost wholly indebted for such immunity as we enjoy from destructive insects to the insect parasites which destroy them. Subsequent experience has confirmed this view, and any measure which involves the destruction of these useful friends should be adopted with caution. I am happy to state that from specimens reared within the past few days, I find that a large proportion of the Hessian Fly is being destroyed by parasites this season. Late sowing has been much recommended, and the results seem to prove that on the whole this is the most practicable remedy—to defer sowing until about the 20th of September, by which time most of the flies will have disappeared. Late sowing, however, has the disadvantage that the plants not being so well established, are not as well fitted to withstand the severe weather of the winter. High culture is advantageous, as the luxuriant growth which the young wheat makes under such circumstances will enable it better to withstand the weakening effects of the grubs. Among the other measures recommended are pasturing the wheat fields with sheep, and the application of lime to the young wheat to kill the larvæ.

During the past few weeks I have examined the roots of a number of sickly-looking grape vines about London, Ontario, and have found the root-inhabiting form of the *Phylloxera vastatrix*, the dreaded scourge of the vine in Europe, in considerable numbers on the young rootlets, and have been able to clearly trace the diseased condition of those vines to that cause. I am convinced that this insect prevails to a greater extent than may at first be suspected throughout our Province, and that it is inflicting material injury, for besides having found it common about London, I have satisfactory evidence of its presence in the neighbourhood of Grimsby, where many vines are reported as diseased, and have also found it recently injuring the vines at Paris, There are no symptoms which indicate the first onset of this insect. It is only after the *Phylloxera* has destroyed a large portion of the roots, that the vine assumes a sickly aspect, becoming stunted in its growth and yellow in the foliage. On examining the roots of a vine so affected, most of the small rootlets—through which the vine draws the chief part of its nourishment—are found dead, and with many small knots and swellings on them. If a few freshly formed, living rootlets can be found, which may in such cases be looked for about the crown of the vine, these minute lice will usually be seen clustering upon them, often surrounded by groups of their eggs, and causing little swellings thereon. But it frequently happens that when the vines have reached this depleted condition, no insects can be found; they have entirely left them, and traversing the interlacing roots of other vines, found their way to richer pastures.

This insect occurs in two very different forms; in one, known as the gall-inhabiting type, it is found upon the vine leaves, producing in June, July and August globular or cup-shaped galls of varying sizes, of a greenish red or yellowish colour, with their outer surface uneven and somewhat woolly. The enlargement is on the under side of the leaf, and if one is cut into, it will be found to contain from one to four orange coloured, wingless lice, and a large number of very minute, oval, pale yellow eggs, with some newly hatched lice. Soon the gall becomes too thickly populated, when the surplus lice wander off through its partly opened mouth on the upper side of the leaf, and establish themselves on the same leaf or on adjoining leaves, where the irritation occasioned by their punctures causes the formation of new galls, within which the lice mature and increase. These galls are quite common, especially on leaves of the Clinton and other thin-leaved varieties, also on the wild grape; they sometimes occur in such abundance as to cause the leaves to turn brown and fall prematurely from the vine, and instances are recorded of defoliation from this cause. Late in the season, as the leaves become less succulent, the lice either perish or seek other quarters, and some of them find their way to the roots of the vines and establish themselves as already described, where, with their change of habit, there follows a slight difference in their appearance. During the winter they remain torpid, renewing their activity in the spring. As the summer advances, a portion of the root lice acquire wings, when they issue from the ground, and rising in the air, they fly or are carried with the wind to neighbouring vineyards, where they deposit their eggs on the under side of the leaves, among their downy hairs, beneath the loosened bark of the branches and trunk, or in crevices of the ground about the base of the vine. The complete life history of this insect, which is extremely interesting and curious, may be found in the 5th, 6th, 7th and 8th Reports on the Insects of Missouri, by Prof. C. V. Riley.

The gall-inhabiting type of this insect may be subdued by picking off the infested leaves and destroying them, but the root inhabiting type is a much more difficult form to deal with. Various applications to the soil have been recommended, such as bisulphide of carbon, and carbolic acid diluted with water and poured into holes made in the soil about the roots; soot, lime and ashes have also been suggested, strewed around the vines.

Several species of predaceous insects prey on this louse. A small fly, an undetermined species of *Diplosis*, deposits its eggs within the gall, in which the larval and pupal stages of this insect are also passed. The larva of this friendly species, although destitute of legs, is very active, and groping about within the hollow of the gall, seizes on the young lice as hatched and sucks them dry. I have found no evidence of its attacking the parent lice, the newly born and tender progeny being more to its taste, and in sufficient abundance to furnish it with a constant supply of fresh food. In some instances one larva, in others two are found in a single gall, but in no instance have I found living lice with the chrysalids, an evidence that its beneficial work is completed before this change takes place. An active mite, *Tyroglyphus phylloxera*, the larva of a Syrphus fly, *Ripiza radicans*, also the larva of a small dull-coloured Lady-bird, a species of *Scymnus*, all aid in keeping in subjection the root-inhabiting form.

Most of our American vines are much more vigorous than the European sorts, and hence are likely to endure the inroads of this insect much better. As the insect is native to our country, our vines must have always been subject more or less to its attacks, and hence probably have developed a hardier constitution, with greater capacity for endurance or resistance. Last year I observed on some Concord vines evidences of unhealthiness, which I now believe arose from the presence of Phylloxera; this season most of them seem to have recovered their natural vigour. This inspires the hope that some of our vines may be able to endure the presence of this pest without very serious injury or loss.

During the month of July I received from Prof. J. A. Lintner, State Entomologist of New York, specimens of parasitized egg of the Gooseberry Sawfly, *Nematus ventricosus*, which he kindly sent me for the purpose of enabling me to introduce the parasite into Canada. This parasite is a very minute four-winged fly, probably *Trichogramma pretiosa*, with very delicate fringed wings. Some of these I placed while still unhatched near to eggs of the Sawfly recently laid on currant leaves. It is sincerely hoped that the effort for their introduction into Ontario will be successful, as they seem to do their work very thoroughly, every egg in the examples sent me being parasitized. The presence of the parasite may be detected by the discoloration of the egg, which becomes brown.

Recently I have received from a correspondent in Oakville, Mr. M. Felan, some examples of the destructive work of *Systena frontalis*, on grape vine leaves. This beetle, although very generally distributed, has not, as far as I know, ever been recorded before as destructive or noxious. In this instance it seems to be quite local in its abundance, as my correspondent informs me that they are not found on his neighbour's vines, although very abundant and destructive on his own, eating the green tissues of the leaf on the upper side and causing it to wither.

Examples of what appears to be a new disease on the pea have lately been brought to my notice from several localities, under the impression that it was caused by an insect. The disease manifests itself in a series of white fleshy swellings at short intervals along the fibrous roots, varying in size from one-sixteenth of an inch to one-eight of an inch or more in diameter, irregular in form, and of a solid fleshy structure. Microscopical examination has convinced me that it is a fungus growth in the production of which insects play no part. It appears to have the effect of stunting the growth of the plants and lessening the crop.

The short fruit crop this year, after the abundant promise of the spring, has been by many attributed to the work of insects, but this I am satisfied is an error, for while in many instances a small amount of injury has been done by insects, the main causes of the failure must be looked for elsewhere. Insects are important agents in the fertilization of fruit blossoms, and at the time of the abundant blossoming of the past season wet weather prevailed with an unusually low temperature, which prevented the insects then on the wing from visiting the flowers; the low prevailing temperature may have also interfered with the proper maturing of the fertilizing agent, while the frequent rains washed away from the opening flowers much of the pollen as formed. To these causes combined may probably be attributed the lack of fertilization of the blossoms. Following this unfavourable weather, and doubtless induced and fostered by it, a species of minute fungus attacked the leaves of the apple, extending over a large portion of their surface, and often down the leaf-stalk to their base, causing a dark brown discoloration. The same fungus attacked the young fruit also, deforming a considerable proportion of the few specimens which were to be found, and these attacks resulted in a withering and curling of the leaves; the young fruit became stunted and deformed, and in many instances much of the foliage dropped to the ground. The effect of this injury, even at this advanced period in the season, is still to be seen in the sparseness of the foliage on many of the trees, in the discoloration of the leaves and the stunted growth of the branches.

It is difficult to anticipate with any certainty the effect of this disease on the fruit crop of next year, but since as a rule any interruption to the healthy growth of a tree leads to the more abundant production of fruit buds, it is probable that with a favourable season, we may have a very abundant yield in 1883.

California has for some years past been shipping fruits from her abundant surplus to all parts of the continent, and her favoured climate furnished conditions under which pears, apples, plums and grapes prospered to an extent unknown elsewhere, and for many years almost free from the insect pests which in other fruit-growing regions levy so heavy a tax on the growers. But this exemption could not be expected to be permanent. The Codlin Moth made its appearance there in 1874, and ever since then has been increasing to an alarming extent, the climate favouring its propagation with a rapidity unknown in less favoured districts, so that there are three, and in some instances four broods in a season. They attack the pears and quinces, as well as the apples, and destroy and disfigure a large quantity of fruit. California fruit growers are also suffering from the Phylloxera, Pear-tree Slug, Red Spider, Tussock Moth Caterpiller, the Currant Borer, a native Tent Caterpiller, *Clisiocampa constricta*, and a number of species of bark lice or scale insects, which attack apple, pear, peach, plum, orange, lemon, fig and olive trees, being found alike on the bark, foliage and fruit, and which multiply with amazing rapidity. Recognizing the vast importance of the fruit crop to the State, the most stringent measures are being enacted for the purpose of subduing these pests. An Act was passed by the State Legislature in March, 1881, in the interests of Horticulture and Viticulture, providing for the appointment of a State Board of Commissioners, one from each of the large fruit-growing districts, with almost unlimited powers to restrain, seize, or prohibit the importation of anything and everything likely to aid in distributing these insect pests—any suspected vines, vine cuttings, empty fruit boxes or other material likely to spread insects or contagion, and any willful violation of the quarantine regulations of this Board is considered a misdemeanor and punishable with a fine of from $25 to $100. These Commissioners are also charged with the duty of preparing rules to be observed by fruit growers for the extermination of insects, and suitable powers are given them to enforce the carrying out of these rules. In reference to the Codlin Moth, every apple grower is compelled to scrape the rough bark off his apple trees every spring, to collect and burn the scrapings, and apply, after scraping, an alkaline wash—the constituent parts of which are specified—to the tree. All boxes in which apples, pears or quinces have been stored or shipped are required to be dipped in boiling water containing a pound of commercial potash to each 25 gallons, for at least two minutes. These measures look to the destruction of the pupa. But, further, bands of cloth or paper of a specified width must be fastened around each apple, pear and quince tree, before the fifteenth day of May in each year, and examined every seventh day afterwards throughout the season, and all larvæ or pupæ destroyed. Precautionary and remedial measures are being enforced in reference to many other destructive insects, and any laxity or omission on the part of fruit growers in carrying out the instructions of the Commissioners is punishable by fine. The chief officer of the Commission is required to visit, examine and report upon the fruit growing interests in the various sections of the State, appoint resident inspectors for each county to enforce the regulations adopted by the Commisson, and to experiment on the best methods of subduing insects and diseases destructive to fruits, and disseminate the information so obtained. For the carrying out of these objects an appropriation is made by the State of ten thousand dollars a year.

Those interested in Economic Entomology will, I am sure, watch with much interest the effect of such vigorous legislation, and if measures of this character can be successfully enforced there, why not elsewhere ? There seems to be a necessity for the general adoption of some stringent measures which would prevent the careless and lazy from making their grounds the breeding places of noxious insects which prey upon and destroy the crops of their more thrifty neighbours.

I have the honour to be,
Yours very sincerely,
Wm. Saunders.

There being no further business, the meeting of the Entomological Society of Ontario was then adjourned.

The meeting then resolved itself into an informal gathering of the Entomological members of the American Association for the Advancement of Science, then in session in the city of Montreal.

On motion, Mr. W. Saunders and Mr. E. B. Reed were requested to act as Chairman and Secretary respectively of the meeting.

Some discussion took place respecting the Entomological Club of the A. A. A. S., when it was moved by Dr. Hagen, and seconded, and duly carried :

Resolved,—That Prof. J. A. Lintner be requested to take the necessary steps to call further meetings of the Entomologists present at this session of the Association, at such times and places as might be determined upon, and also to provide for similar meetings for Entomological discussions at the future gatherings of the Association.

PEA FUNGUS.

Mr. Geo. McCloskie, of Princeton, N. J., asked for some information about a peculiar fungus-like growth on pea roots, referred to in Mr. Saunders' address. The Chairman gave it as his opinion that it was a fungus.

Samples were shown exhibiting the pea as affected by this disease.

COTTON WORMS.

Mr. Jas. Fletcher asked if there was any further information respecting the habits of the Cotton Worm Moth, *Aletia argillacea*, he believing that from its frequent occurrence in Ontario in such a perfect condition, it must breed in Canada; he was aware that the larva had never been found here and that Prof. Riley had in his able paper on this moth, expressed his conviction that the moth did not breed in Canada.

Prof. Riley stated that so far as he knew from repeated observations and experiments, the cotton plant, *Gossypium*, was the only food plant of this insect; he thought that the peculiar formation of close-fitting scales of the wings would account for the apparently fresh condition of the moths found in Ontario, and he believed that the insect possessed ample powers to fly such a distance as that from the Southern States to Canada. There might be a probability that the insect bred in the Northern States, but he was still of the opinion that the moth was a purely Southern species.

Dr. Hoy stated that he had found in Wisconsin a specimen of the moth at the end of August, with the fore and hind wing on one side of the body in a deformed and crippled state, evidently showing that it must have very recently emerged from the chrysalis. He also stated that a female moth had been captured near his residence about the middle of June. He thought the insect must breed in the North sometimes.

Prof. Comstock confirmed Dr. Hoy's statement as to the finding of the crippled moth, but thought, however, that the moth generally bred in the South.

Prof. Fernald said he had seen fresh specimens taken in September, in Maine.

The Chairman said that occasionaly fresh moths and butterflies might be captured in entirely new localities, but that generally some probable reason could be given for their appearance; as, for instance, he remembered that many years ago two fresh specimens of *Euptoieta columbina* had been found at St. Catharines, Ont., a place where they had never before or since been observed, but that they had probably found their way there among the large number of fruit and other trees imported from the States; still, however, no such probable reason had been suggested for the appearance of the Cotton Worm Moth in Ontario, in such frequent numbers and at so many different localities. The matter was one of great interest.

Mr. Fletcher said he hoped the members would continue their observations of this insect, the larva of which, if found in Canada, would probably feed on some *Malvaceous* plant.

Prof. J. A. Cook stated that from the European larch he had taken about 250 cocoons of *Samia Columbia*, and found among them one peculiar cocoon, very similar to that of *Columbia*, which eventually produced a *cecropia.*

Dr. Jewett thought it was probably a case of hybridism, as he himself had taken hybrids of *Gloveri* and *cecropia.*

Dr. Hagen had seen cocoons of *cecropia* so similar to those of *Columbia* that it would be very hard to discriminate between them.

Dr. Hagen also gave a very interesting account of an expedition to the Northwestern Territories from which, in company with Prof. Henshaw, he had just returned.

In the north of Washington Territory he found the forests and country generally in splendid condition, and comparatively free from any insect pests.

In other parts he had found the Yellow Pines most seriously affected by the attacks of *Pieris marsupia* (?), large tracts of forests being entirely devastated—and large trees being attacked as well as the younger ones. The Butterfly appeared there last year for the first time—eggs were found on July 24th. The larva has the habit of dropping from the trees by a thread, a peculiarity only noticeable in a very few of the Rhopaloceræ.

A tree once attacked never seems to recover, and the only way to check the ravages of the insect is to cut down those trees affected.

In Montana the cattle feed out all the year round on the " bunch " grass, which is of inestimable value to that country. A curious fact to be noticed is that wherever timothy and blue grass is introduced it seems to kill out the bunch grass, so that the advance of civilization may in fact entirely alter the economy of the country.

The grasses do not seem to be troubled as yet with any pests.

The Colorado potato bug is merely known in certain localities.

The fruit trees are troubled only by flies and ants, so that the territory is nearly free from noxious pests.

Prof. Henshaw said the expedition was one of great interest.

A curious feature was the late hours at which insects appeared to feed, many of them after sundown.

Papalio machaon was found in great numbers.

Carabidæ were found in dry places, whereas in the East they usually preferred moist situations.

The genus *Callopteryx* was also found. This was especially noticeable as it had never been known to occur west of the Rocky Mountains.

After this a considerable time was spent in informal discussion and examination of interesting specimens brought by members from various parts of the continent, and the meeting then adjourned.

POPULAR PAPERS ON ENTOMOLOGY.

ENTOMOLOGY FOR BEGINNERS.

The Southern Cabbage Butterfly—*Pieris protodice.*

By W. Saunders, London, Ontario.

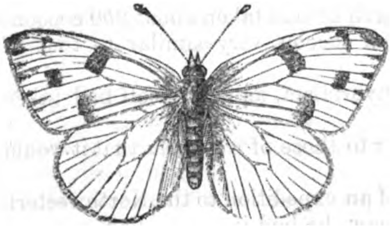

Fig. 1.

In figure 1 we have represented the male, and in figure 2 the female of the Southern Cabbage Butterfly, an insect by no means confined to the South, although much more abundant there than in the more northerly portions of America. This insect enjoys a wide geographical distribution, extending south-west as far as Texas, west to Missouri, north-west to the Red River, and along the east from Connecticut to the Southern Atlantic States. A few years ago it was not uncommon around London, and occasionally quite plentiful about the shore of Lake Erie at Port Stanley; but of late years it has become a rare insect with us, and we have not met with a specimen on the wing for several years. The English Cabbage Butterfly, *Pieris rapæ*, seems to have taken its place entirely.

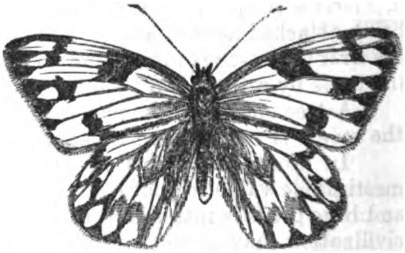

Fig. 2.

The butterfly is a very pretty one, as will be seen by the figures. The ground colour in both sexes is white, with black spots and black and dusky markings which are much more numerous in the female than in the male. Although so rare in Ontario that it has never, as far as we know, been reported as injurious, it is frequently very destructive to the south of us. According to Mr. Riley, it is abundant in Missouri, and often proves exceedingly injurious, sometimes destroying in a single district thousands of dollars worth of cabbages.

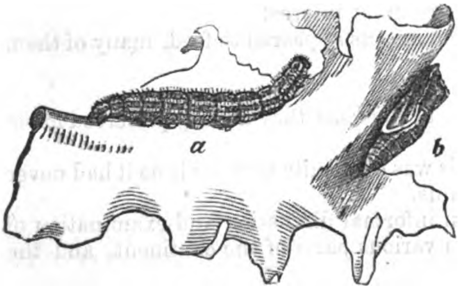

Fig. 3.

The caterpillar when full grown (figure 3, *a*), is about an inch and a quarter long, of a bluish-green colour, with four longitudinal yellow stripes and many black dots; when first hatched it is of an orange colour with a black head. The chrysalis, shown at *b* in the figure, is about seven-tenths of an inch long, of a light bluish-grey colour speckled with black, with the ridges and prominences edged with buff or flesh-colour, and having larger black dots.

The insect hybernates in the chrysalis state, and where common may be found on the wing during the months of July, August and September.

The Great Leopard Moth—*Ecpantheria scribonia* Stoll.

The larva of this insect is comparatively abundant in the autumn throughout most of the Northern United States and in many parts of Canada. It is found feeding on various species of plants, but most commonly on the wild Sunflower, *Helianthus decapetalus.* It is about two and a half inches long, with a shining black head shaded with reddish on the sides, and a brownish black body. Each segment has an irregular transverse row of tubercles from which spring tufts of rigid shining black hairs, while the spaces between each segment from the fourth to the tenth inclusive are banded with red, the bands being widest and most conspicuous from the sixth to the ninth inclusive. These bands are a striking feature in the appearance of the caterpillar, especially when it is coiled up as shown in figure 4 (after Riley). The colour of the under side varies from reddish to yellowish brown, feet reddish, prolegs brown, thickly clothed with short hairs.

This larva attains its full growth in the autumn and hybernates during the winter under logs, the loose bark of decaying trees, or other suitable hiding places. By the genial warmth of spring it is aroused from its torpid condition and feeds for a few days on grass, or almost any other green thing it may meet with. It then constructs a loose cocoon, within which it enters the chrysalis state.

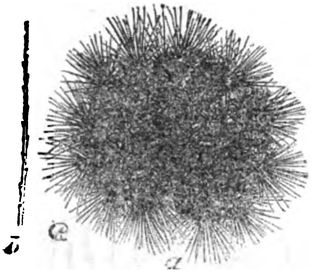

Fig. 4.

The chrysalis is black with a beautiful bloom on its surface, which is easily rubbed off; it has a flattened projection at its hinder extremity, which is tipped with a few bristles.

After remaining about a fortnight in the pupa state, it appears as a unique and very beautiful moth. In figure 5 (after Riley) *a* represents the female, *b* the male. The wings are white, ringed, streaked and spotted with dark brown as shown in the figure. The thorax has ten or twelve black spots with a bluish white centre; the upper portion of the body is steel blue, streaked along the middle and sides with yellow or orange; legs white, ringed with black at the extremities. The male differs from the female mainly in his smaller size and narrower abdomen.

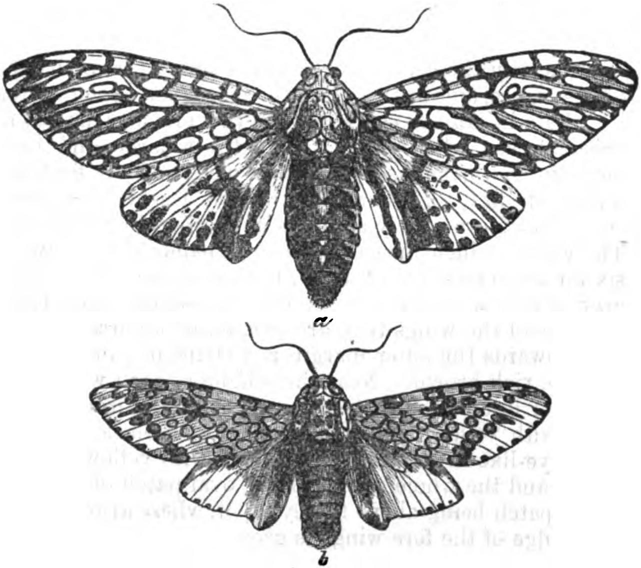

Fig. 5.

THE POLYPHEMUS MOTH—*Telea Polyphemus.*

The caterpillar of this insect is also known as the American Silk Worm, in consequence of its having been extensively reared for the sake of its silk. When full grown the larva presents the appearance shown in figure 6, is over three inches in length, with a very thick body. It is of a handsome light yellowish-green colour, with seven oblique pale yellowish lines on each side

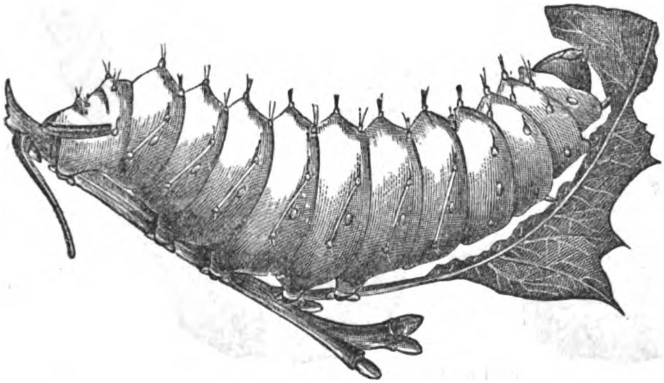

Fig. 6.

of the body; the segments, which have the spaces between them deeply indented, are each adorned with six tubercles, which are sometimes tinted with orange and have a small silvery spot on the middle, and from each one of which arise a few hairs. The head and anterior feet are pale brown, the spiracles pale orange, and the terminal segment bordered by an angular band resembling the letter V, of a purplish-brown colour.

When mature the caterpillar proceeds to spin its cocoon within an enclosure usually made by drawing together some of the leaves of the tree it has fed upon, some of which are firmly fastened to the exterior of the structure. The cocoon, fig. 7, is a tough pod-like structure, nearly oval in form and of a brownish-white colour, and within it the larva changes to an oval chrysalis of a chestnut brown colour, represented in fig. 8.

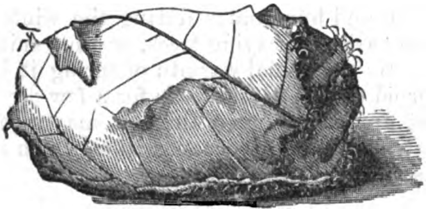
Fig. 7.

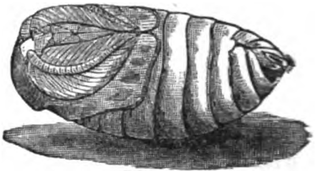
Fig. 8.

Usually the cocoons drop to the ground with the fall of the leaves, and in this state the insect passes the winter.

Late in May or early in June the prisoner bursts its prison house, when there is revealed a large and most beautiful moth, the male of which is well shown in fig. 9, the female in fig. 10. The antennæ are feathered in both sexes, but more widely so in the male than in the female. The wings, which measure, when expanded, from five to six inches across, are of a rich buff or ochre yellow colour, sometimes inclining to pale grey or cream colour, and sometimes assuming a deeper, almost brown colour. Towards the base of the wings they are crossed by an irregular pale white band, margined with red; towards the outer margin is a stripe of pale purplish white, bordered within by one of deep, rich brown. Near the middle of each wing is a transparent eye-like spot, with a slender line across the centre; those on the front wings are largest, nearly round, margined with yellow, and edged outside with black. On the hinder wings the spots are more eye-like in shape, are margined with yellow, with a line of black edged with blue above, and the whole set in a large oval patch of rich brownish-black, the widest portion of the patch being above the eye-spot, where also it is sprinkled with bluish atoms. The front edge of the fore wings is grey.

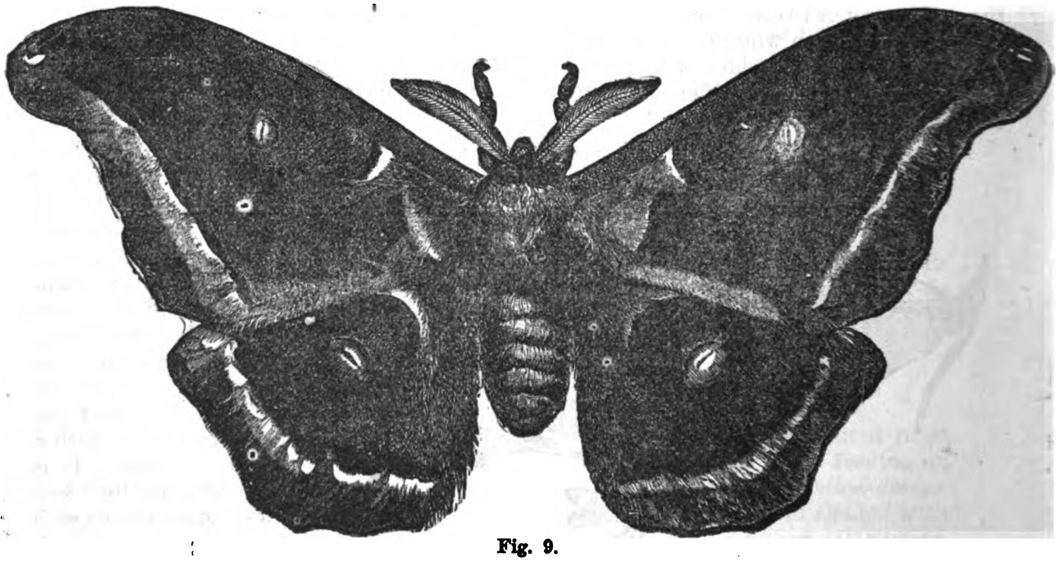
Fig. 9.

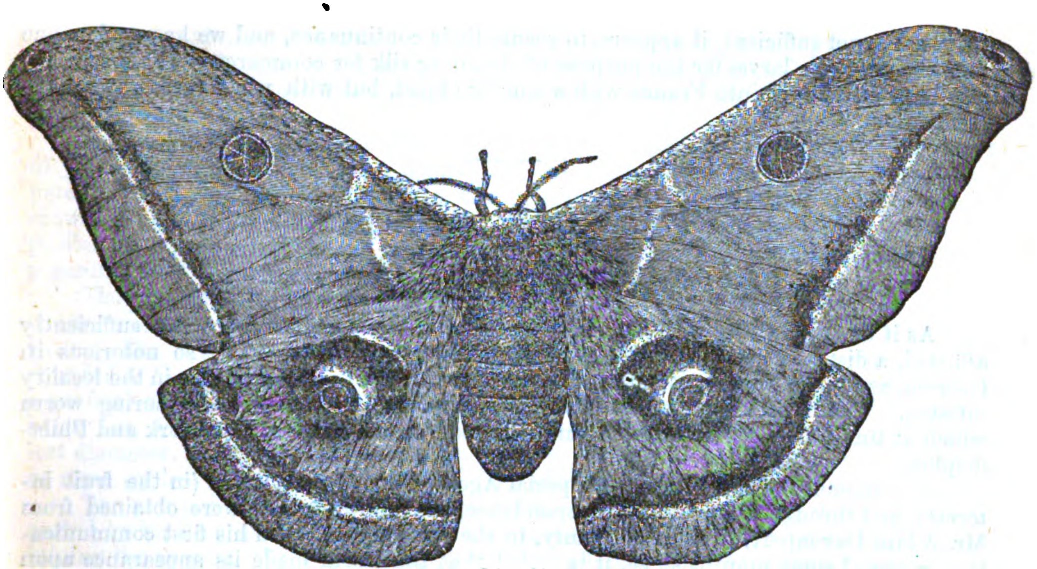

Fig. 10

This lovely creature flies only at night, and when on the wing is of such a size that it is often mistaken in the dusk for a bat. Within a few days the female deposits her eggs, glueing them singly to the under side of the leaves, usually one only on a leaf, but occasionally two or even three may be found on the same leaf.

The egg is about one-tenth of an inch in diameter, slightly convex above and below, the convex portions whitish, and the nearly cylindrical sides brown. Each female will lay from two to three hundred eggs, which hatch in ten or twelve days.

This insect is subject to the attack of many foes, particularly while in the larval state. A large number fall a prey to insectivorous birds, and they also have insect enemies. A large ichneumon fly, *Ophion macrurum*, see fig. 11, is a special and dangerous foe. This active creature may often be seen in summer on the wing, searching among the leaves of shrubs and trees for her prey. When found she watches her opportunity, and places quickly upon the skin of her victim a small oval white egg, securely fastened by a small quantity of glutinous substance attached to it. This is repeated until eight or ten eggs are placed, which in a few days hatch, when the tiny worms pierce through the skin of the caterpillar and begin to feed on the fatty portions within. The *Polyphemus* caterpillar continues to feed and grow, and usually lives long enough to make its cocoon, when, consumed by the parasites, it dies; in the meantime the ichneumons, having completed their growth, change to chrysalids within the cocoon, and in the following summer, in place of the handsome moth there issues a crop of ichneumon flies. It is also subject to the attacks of another parasite, a tachina fly. Should the insect ever appear in sufficient numbers to prove troublesome, it can be readily subdued by hand-picking. This larva feeds on a variety of trees and shrubs, such as plum, oak, hickory, elm, basswood, walnut, maple, butternut, hazel, rose, &c.

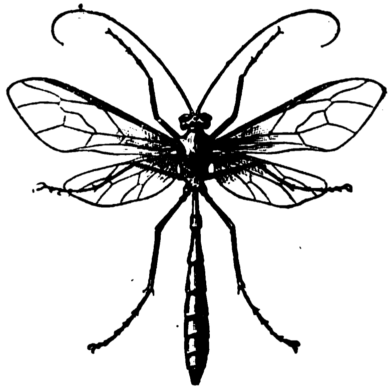

Fig. 11.

As this moth has been found to be easily propagated, extensive experiments have been tried with the view of producing silk for commercial purposes from the cocoons. The silk is rather coarser than that of the common silk worm, *Bombyx mori*, has a continuous thread and can be readily unwound. A measure of success has attended these efforts, but not sufficient, it appears, to secure their continuance, and we know of no one now raising these larvæ for the purpose of obtaining silk for commerce. The insect has also been introduced into France with a similar object, but with what success we have not learned.

A NEW APPLE TREE PEST.

By Charles R. Dodge, Washington, D. C.

As if the apple tree with its sixty or more insect enemies were not sufficiently afflicted, a distant relative of the Canker-worm has been making itself so notorious in Georgia, as to give apprehension of the total destruction of apple orchards in the locality infested. The insect complained of is *Eugonia subsignaria* Pack., a measuring worm which at times has been a veritable nuisance upon shade trees in New York and Philadelphia.

In pursuance of my duties as a Special Agent of the Census Office (in the fruit interest), and through subsequent correspondence, the following facts were obtained from Mr. Adam Davenport, of Fannin County, in the state named. In his first communication, received some months since, it is stated that the worm made its appearance upon Rich Mountain, a spur of the Blue Ridge, about four years ago, attacking forest and fruit trees; and that it had since spread over a large area, doing great damage. Apple trees in June last were as destitute of leaves as in mid-winter, the fruit growing to the size of marbles and falling off.

A late communication—with the replies to a series of questions—shows the destruction to be even worse than at first reported. I give Mr. Davenport's own words:—

"The insect made its appearance four years ago upon Rich Mountain, since which time it has been spreading in a northern semi-circle, at the rate of about fifteen miles a year. It is by far the most interesting insect that has plagued this country since the first white settlement. So wonderfully prolific that in two years it literally covered every tree, bush and shrub, and with the exception of a few varieties, stripped them of their leaves.

"The egg hatches about the first of May, and the caterpillar, which is dark brown, lives about forty days, transforms to a chrysalis, lives in this state about ten days, and emerges a milk-white miller. For two weeks before the first transformation the fall of their excreta, in the woods, resembles a gentle shower of rain, and from its abundance tinges the streams a dark green hue. I have seen trees that had been stripped of their foliage, entirely wrapped up in their silken webs, resembling, when covered with dew, a wrapping of canvas. They constitute a great feast for all insectivorous birds and animals; it is said that even cattle and sheep eat them with great greed. They have an instinctive way of protecting themselves by losing their hold upon the limb, at the slightest touch, and swinging by their web in the air. For this reason they are easily shaken off into sheets and destroyed. However, they are so numerous, this remedy is worth nothing except in keeping them off very small trees. This instinct is not lost after leaving the caterpillar state, for if a bird alights upon a tree above the millers, they suddenly drop like a shower of snow to the ground for protection."

In the *Practical Entomologist*, volume 1, page 57, an anonymous writer gives an account of this insect's attacks on elms in Philadelphia. Dr. Packard, in his Monograph of the Geometrid Moths, page 528, mentions only elm as a food plant; but Prof. Thomas, in his second Illinois Report, page 243, says: "I have not noticed them feeding upon that tree, but have twice found them feeding upon apple, upon the leaves of which I have reared them to the perfect insect. In neither case were they numerous." Prof. Comstock makes brief mention of the insect in his recent report as United States Entomologist, quoting Mr. Davenport, as above, to the effect that the worms were destroying forests of hickory and chestnut, and were damaging fruit trees. This statement doubtless refers to the season of 1880.

The infested district in Georgia is not less than sixty miles long by forty wide, and embraces Union County on the east, Gilmer on the west, and Polk County, Tennessee, on the north. They have been injurious two years, but in the summer of 1881 they were most destructive.

It is stated in the *Practical Entomologist* that the eggs are deposited in masses of fifty upon the limbs of the tree. A piece of apple bark before me presents an irregular patch over three inches long, and one-fourth to one-half inch broad, the eggs closely crowding upon each other. As there are many hundreds, they have doubtless been deposited by a number of moths, which attests the truth of Mr. Davenports's statement regarding their falling in showers like snow.

They are deposited for the most part on the under side of the limbs on the top of the trees, and not only upon the bark, but the tufts of moss are covered by clusters of them. The eggs are smooth, dull, irregularly ovoid, slightly flattened upon the sides, rounded at the bottom, while the top is depressed, with a whitish rim or edge, forming a perfect oval ring; colour yellowish brown, resembling brown glue; length of examples before me, ·04 inch; width, lying upon the flattened side, ·03 inch; thickness, or smallest diameter, ·02 inch. They are deposited in curved or straight rows of a dozen or more (or less), these lines forming masses often of many hundreds.

The name *Eugonia subsignaria*, is given on the authority of Mr. Davenport, supported by his descriptions in answer to my questions, as I have had no means of determining the species. There is no doubt in my mind, however, of the insect's identity.

THE HOP-VINE BORER.

The casual reader, calling to mind only the half dozen hop-vines usually seen about the kitchen garden, or trailing upon some farm out-building, can hardly realize the possible losses to hop growers by insects. According to the last census (for 1879) New York State alone had over 39,000 acres in hop yards, producing nearly 22,000,000 lbs. of hops, which, at an average of 28c. per lb., would aggregate a value of over $6,000,000. Bearing these figures in mind, with an annual loss of 10 per cent. from only one insect —the hop borer—(and 25 to 50 per cent. of injury has been reported) a loss of $600,000 would result in this single State.

With such a destructive agent in the hop field, is it not a little singular that there is little or nothing "in the books" on the subject, and that the pest is in all probability an unknown and undescribed species? I am not able to give its name—Prof. Comstock writes me he is working it up—but as I have accumulated a mass of interesting data on the subject in my census work, I deem it proper to make known now the experience of intelligent growers in different sections of the country, for the benefit of those who have not yet learned how to fight the pest, leaving the scientific name and details of habits and natural history to be supplied hereafter.

The only mention that I can find of an insect boring into the crown of the hop plant, in the manner set forth by numerous correspondents, occurs on page 33 of the Report of the Entomological Society of Ontario for 1872, by Rev. C. J. S. Bethune. As an appendix to his paper on Hop Insects, he gives descriptions of an unknown larvæ feeding "upon the crown of the root," and which he was unable to rear. The size of the larvæ and the general points of description agree so well with the unscientific descriptions given by my correspondents, the growers, that I unhesitatingly pronounce them to be the destructive hop borers, which are the subject of this paper.

The pest has been known to cultivators of the hop for many years—indeed it is reported from Oneida County that it has always been known in the locality—and other hop growing districts have felt its presence for longer or shorter periods. In Juneau County, Wisconsin, it was first noticed in 1867, while the observer in Waupaca County had not noticed it prior to 1881. The percentage of destruction varies in different sections from almost nothing—where kept under control, or yards are new—to 25, 50, and even a greater percentage where the yards are old, badly infested, or not looked after. These facts lead a New York grower to state, in his opinion, that it is best to abandon yards after six or eight years' culture, and change to new ground, for "grubs will get into a yard after two or three years, gradually increase, and in eight or ten years spoil the yard." Other growers contend that only the yards of the ignorant and shiftless are ever damaged to any extent by the borer.

I shall not attempt to give a description of the larva here, further than to say that all correspondents agree in the statement that it is an inch and a quarter to an inch and a half in length, and three-sixteenths to one-fourth inch in diameter at maturity, whitish or light gray in colour with a dark head.

As soon as the vines start from the ground in May and June, and when but a few inches high, the mother insect begins the attack by depositing her eggs upon them. The subsequent injury is thus described by Mr. Pierpont, a large grower of Ontario County:—

"The warm sun hatching the egg deposited in the head of the hop vine, soon after it is out of the ground, it soon becomes a lively worm about one-fourth of an inch in length, subsisting upon the sap of the 'vine. It leaves the head of the vine soon after hatching, enters the ground, bores to the centre of the vine and works up an inch or two, finally locating where the vine starts from the crown, eating at this point and at the crown until the vine is nearly or quite destroyed, and the crown weakened by water getting in, causing decay, and finally the destruction of the entire hill."

Another report states that the insect begins work in the latter part of June by eating into the tender vines where they start from the old crown or bed root; and unless prevented, will eat the vine entirely off, thus destroying the crop; "many times they poison the root so that the whole hill dies." Old yards die from this cause more than any other, as the borer prevails more in old than in newer ones.

Another grower states that the damage commences about the last of May or first of June, when "the head of the vine will appear slightly bent or curved, if compared with sound ones. The grub, after feeding a little time in the heart of the head drops to the ground and makes its way into the heart of the vine below the surface of the ground, working deeper as it grows larger. The vine wilts and finally dies."

There is great diversity of opinion among growers as to the best means of ridding a yard of these pests. A few take for granted that there is no remedy, leaving skunks to carry on the warfare alone; and right here it may be stated that growers east and west speak most favourably of the friendly offices of this much despised animal in the hop yard. Salt is mentioned by many growers as a remedy. It is put on after the vine has become somewhat toughened, from middle to last of June, salt on the tender new stalks killing them in a short time. Lime, ashes, sulphur, etc., are also recommended, but doubtless do little real good. Some growers emulate the skunks by digging out the grubs, often doing more damage than the pests themselves.

Mr. Pierpont says an experienced tyer of hops can tell at a glance the head containing a worm, which is crushed in an instant, but this process can only be practiced for a few days, as the worms leave the head soon after hatching. Next to the crushing process a useful remedy is to hill the hops as soon as possible and give the yard thorough cultivation. The hilling causes fibrous roots to put out above the operations of the grub and save to some extent the crop.

The most detailed statement of experience, and it seems to me the best remedial agency or means of prevention, is furnished by Mr. J. F. Clark, a grower of Otsego county, New York, who writes as follows:

When the vines are well up the poles, and at the first hoeing about the last of May or first of June, the dirt should be carefully worked away from the vine by the hoe; all the dirt remaining between the vines must be carefully worked out with a sharpened stick, so that all the vines will be left bare as low down as where they leave the bed root; thus they become toughened by the weather, and are not so attractive to the grub. Immediately after this operation, a good handful of the following compost should be applied directly around the root and vine: Take equal parts of salt, quicklime and hen-manure; place the lime on the floor first, and throw on water enough to thoroughly slack it; immediately spread the salt on top, following with the hen-manure. When the lime is well slacked, mix the whole thoroughly, and in a couple of weeks it will be ready for use, as above. Do not hill up the hops until the latter part of July or first of

August, and the yard wlll not suffer any from grubs, but will remain clean and free from weeds the remainder of the season. When yards are hilled earlier than stated above, the grub sometimes works in them more than in late hilled ones.

To return to the skunks. They seem to have acquired the digging-out process to perfection—far better than the hop grower—as they are able to dig around the hills without the least injury to the vines. In Juneau county, Wisconsin, this little fellow—with an appetite for juicy grubs only equalled in degree by the pungency of his perfume—is the only positive remedy, as he works about the hop-hills or roots, cleaning out the worms in a few nights. One grower says: "I have seen ten acres where not a dozen hills would escape their little noses."

It is worthy of note that in a majority of cases the growers report the borer as the most injurious insect in the hop yard, not excepting the hop-aphis.

THE PICKLED FRUIT FLY—*Drosophila Ampelophila* (Loew).

By G. J. Bowles, Montreal.

In August, 1879, I met with a small Dipterous fly, *Drosophila ampelophila* Loew, in considerable numbers, and as the subject is of interest to entomologists, I give the result of my observations. I have to thank Professor Hagen, of Cambridge, for the determination of the species and other information, and also Professor Lintner, of Albany, for a copy of his article in the *Country Gentleman* of 1st January, 1880, on this insect, and from which I have largely drawn.

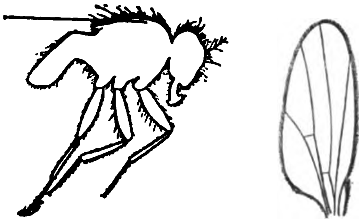

Fig. 12.—*Drosophila ampelophila:* Fly and Wing. Magnified 10 diameters.

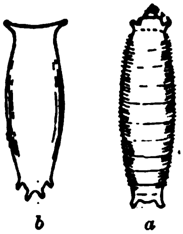

Fig. 13.—*Drosophila ampelophila.* *a*, Larva; *b*, Pupa. Magnified 7 diameters.

With regard to the genus, Professor Lintner says: "Twenty-five North American species of *Drosophila* are catalogued, which have all, with the exception of three species common to Europe and America, been described by Dr. Loew, the distinguished Prussian Dipterist, and Mr. Walker, of the British Museum. They have not been studied by our American entomologists, and consequently nothing is known of their habits. I find no reference to a single determined species by any of our writers." In the *American Naturalist*, vol. 2, page 641, an unknown species of *Drosophila* is noticed as infesting apples, preferring the earlier varieties. The larvæ penetrate the interior of the apple in every direction, and if there are several working together, render it quite unfit for use. Dr. Packard, in his *Guide*, page 415, figures an unknown species as the "Apple Fly," which is believed to be the above species. Mr. Walsh, in vol. 2 of the *Practical Entomologist*, also gives a brief notice of a larva supposed to be that of a species of *Drosophila*, and which also was injurious to an apple crop in Vermont to the extent of about half its value, by boring the fruit in every direction.

Professor Lintner further says: "The different species of *Drosophila* vary considerably in their habits, as we learn from European writers; and, indeed, the same species seems often to occur under apparently quite different conditions. The larvæ of the European *D. cellaris* occur in fermented liquids in cellars, as wine, cider, vinegar and beer, and also in decayed potatoes. *D. aceti* Kol. infests decayed fruits. Its larvæ occupy about eight weeks in attaining their growth, and their pupal state lasts for ten or twelve days. The flies appear in May and June. *D. funebris* has been reared from pupa taken from mushrooms. It is sometimes known as the vinegar fly. Another European species, *D. flava*, is stated by Curtis to mine the leaves of turnips, raising blister-like elevations on their upper surface."

The present species, *D. ampelophila*, is described by Loew in *Centuria Secunda* (Dipt. Amer. Sept. indigena), No. 99, page 101. It is exceedingly common (Professor Hagen states) in the southern parts of Middle Europe and in Southern Africa, but the only localities given for it in America, in Loew and Osten Sacken's Catalogue, are the district of Columbia and Cuba. Professor Lintner, however, has bred it in New York; it also occurs in Pennsylvania, and now Montreal must be added to the list. I also think, from observations made in Quebec, that it, or an allied species, is found there. At any rate, this immense area of distribution for such an insignificant insect is very remarkable.

Like the other species of this genus, and so many other dipterous insects, the larva of *ampelophila* feeds on decaying or fermenting vegetable matter. Professor Lintner bred it from pickled plums; in Pennsylvania it fed on decaying peaches, and I found it in pickled raspberries. An earthenware jar had been nearly filled with this fruit and vinegar, prepared by the good housewife for the purpose of making that favourite drink (in Canada at least) called raspberry vinegar. On opening the jar about ten days afterwards (16th August, 1879) it was found to be swarming with the larvæ and cocoons of the insect. Hundreds of the larvæ were crawling on the sides of the jar and the under side of the cover, while pupæ were found abundantly, singly and in clusters, particularly where the cover touched the top of the jar. The short time required for the production of so many individuals was surprising. I half filled a covered tumbler with the pickled raspberries and larvæ, and they continued to produce flies for several weeks. I regret not having more attentively observed the exact time required for the different stages, and can only say that its growth from the egg must be very rapid, and its pupal state does not last longer than ten or twelve days.

The larvæ (fig. 13 *a*) when full grown, are nearly one-fourth of an inch long, somewhat tapering towards the head, which is small; and are sparsely covered with minute hairs, particularly on the divisions of the segments. They have no feet, but can travel quite rapidly on glass, seeming to retain their hold by a glutinous condition of the skin, and moving by extending and contracting their bodies. They seemed to exist with ease either in the vinegar or the air, moving through the former in search of food, and sometimes coming out of it, and either resting or moving about on the glass sides of the vessel. Their bodies were quite transparent, and under the microscope their internal organs could easily be seen. At both ends of their bodies are curious projections or tubercles, which are also seen in the pupa.

The puparium (fig. 13 *b*) is about three-sixteenths of a inch long, oval in shape, and yellowish-brown in colour, with the tubercles at head and tail before referred to.

The fly (fig. 12) measures about one-eighth of an inch in length, with a large rounded thorax, long legs, and broad iridescent wings. The whole insect is yellowish in colour, and very hairy, even to the proboscis. Some of the hairs on the head bear three or four branches. The wing forms a very beautiful object for the microscope.

Last year the flies were attracted to some raspberry wine in process of fermentation, hovering about the jars and alighting upon the corks, evidently seeking for an opening through which they might pass to lay their eggs. It is doubtless in this way that fruit is attacked by this or some allied species, The minute fly effects an entrance beneath a not closely-fitting lid, and deposits its eggs on the fruit, or upon the side of the jar, whence the young larvæ make they way to the fruit, or find their sustenance in the liquid.

During the past summer I was desirous of again testing the matter. A few raspberries, with a small quantity of vinegar, placed in a pickle bottle with a loose cover, were quite sufficient. A fortnight afterwards a number of larvæ were seen in the bottle, and several pupæ were attached to its sides. Absence from home, however, interfered with the carrying out of the experiment. It could easily be tried this season by some of our entomologists, and the time required for the transformations of this curious fly be determined, as well as the further extent of its distribution.

The outline drawings were made under the microscope, and give a fair idea of the insect. Every part of the fly is covered with hairs of different lengths, as indicated in the figure. The branched hair on the head is faithfully copied from a specimen, but in others it was not so largely developed. The wings are beautifully edged with hairs, and the membrane is also studded with them. The fly was drawn in the position given, so as to show its extremely long legs, and the curious shape of the thorax and abdomen.

"LONG-STINGS."

By W. Hague Harrington, Ottawa, Ont.

Among the conspicuous insects which attract the attention of even non-entomologists, there are few more interesting in their structure and habits, as well as in their relations to other groups, than the large "long-sting" ichneumons with their long triple "tails." Our two largest species belong to the genus Rhyssa (of the Hymenoptera), and as, so far as I am aware, no accounts of them have yet been published in the Entomologist, a brief description of their appearance and habits may not be undesirable.

They may be easily distinguished from their relatives (often their victims), the "horn-tails"—Uroceridæ—as they are much more slender in body and appendages. The female, readily determined by the extraordinary development of the ovipositor, has the abdomen stouter than that of the male, with the posterior segments dilated and curved under, and bearing the ovipositor, which is constructed essentially of the same parts as is that of a "horn-tail," only that they are greatly lengthened.

The head, in shape like a short segment of a cylinder, slightly convex before and concave behind, bears on its rounded front a pair of large eyes, from between which spring the long slender antennæ. The head is joined by a small neck to the thorax, which is strongly built and supports two pairs of long narrow wings, as well as the six very long and slim, yet strong, legs. The segment of the abdomen which adjoins the thorax is much less in diameter than the succeeding ones.

The male has a long cylindrical abdomen tapering gradually to the extremity. This, in connection with the prominent head and narrow wings, gives him, especially when in flight, a considerable resemblance to a dragon-fly, from which, however, he is at once distinguished by his long antennæ and shorter hinder wings.

In these insects, as in the Uroceridæ, the hinder-wing has upon its anterior margin a row of minute hooks with which to hold the posterior border of the front one. The number of the hooks is, however, much less, there being only about a dozen scattered along the outer half of the wing.

Of our two species the larger and handsomer is *R. atrata*, of which my specimens vary in length from a little over one and one-quarter inches to nearly two. The head is a rich yellow, with the exception of the eyes and a slight band, bearing the ocelli, on the vertex. The slender antennæ, about an inch long, are also yellow, as, likewise, are the extremely long legs, with the exception of the upper joints of the posterior pairs. The thorax and abdomen are black. The wings, which expand from two to two and three-quarter inches, are transparent, but with a dark smoky tinge. The female is furnished with an ovipositor from *four to five and one-half inches in length ;* flattened and scarcely stouter than a hair.

R. lunator is more common, at least in this vicinity, and varies much more in size, the largest specimens being fully twice as big as the lesser ones. The body varies in length from three-quarters of an inch to one and one-half inches, and bears at its posterior extremity an ovipositor projecting from one and one-half to three and three-quarter inches.

The head is yellow with a dark band, in which are inserted the three ocelli, between the eyes, parallel to which runs another dark line which almost encircles the head.

Lines also run from the base of the antennæ to the mandibles. The slender antennæ are dark at the base but get lighter toward the tip. The thorax and abdomen are dark brown, ornamented with lines and borders of yellow, which is also the colour of the legs. The wings (front pair) expand from one and one-quarter to two and one-half inches, and have a quadrangular dark patch on the anterior border.

The larvæ of both "long-stings" feed upon those of the Uroceridæ and other wood-borers, in which the female ichneumon deposits her eggs by means of the long ovipositor. The method of performing this operation may often be witnessed during the summer by visiting beech trees in which Tremex larvæ are at work, but it is difficult to describe clearly its accomplishment and the different postures of the insect during the progress of her laborious and dangerous duty. A series of good drawings would best convey a correct idea of the process, but I do not know of any book in which such are to be found, while some illustrations are very inaccurate. For instance, I saw the other day in a text book of zoology an ichneumon depicted with her ovipositor fully inserted in the tree and with the *side-pieces or sheaths sticking straight out behind her.* Such an attitude is altogether unnatural, and I am convinced that in that position she would be powerless to extract the ovipositor.

Selecting a suitable tree, if we find no ichneumons at work, we may shortly see one flying strongly and noisily through the sunny woods and settling upon the bark where perforations mark the exits of previous occupants. Here she runs around until she finds a promising spot, as, for instance, the hole made by a Tremex in depositing her egg. Placing herself so that the tip of her abdomen will be above the orifice to be probed she makes herself as tall as possible, and, by elevating her abdomen and curving under the ovipositor, succeeds in inserting the tip of the latter in the hole.

If the dorsal surface of the abdomen be examined, there will be observed, between the sixth and seventh segments, a gap closed by a whitish membrane. This marks an admirable contrivance to enable the insect to use her seemingly unwieldy weapon, for the membrane is capable of being so dilated as to form a cavity in the posterior part of the abdomen, in which can be coiled a large portion (more than one-third) of the ovipositor, which thus becomes perpendicular under the insect, where it is guided and supported by the sheaths which bend up in loops over her back. By vigourous muscular contractions of the sac, the delicate ovipositor is slowly forced down the larva's burrow, often to its full extent. If a larva be reached an egg is deposited in it, and the ovipositor is slowly withdrawn in a similar manner. This, however, the insect is frequently unable to accomplish, and remains struggling until some bird or tree-toad snaps her up, or she perishes from exhaustion.

I have seen a large *R. atrata* with her ovipositor (five and one quarter inches long) inserted four and one-half inches into a beech, so firmly that it was only by careful and vigourous pulling that I extracted it uninjured.

The insects are to be found during the latter part of the summer; *R. lunator*, as already mentioned, being much the more abundant.

On the last day of June, 1879, while collecting in a grove just beyond Rideau Hall, I stopped to examine a dead tree for bark and fungi beetles, and was bottling a fine *Penthe pimelia*, when the rustling of insect wings above me attracted my attention. Looking up I saw several specimens of *lunator* flying about the trunk, and a circuit of the tree with closer inspection showed many others walking about on the bark or in various stages of the act of ovipositing. The tree was a large one, about two feet in diamter, from which the top had been broken off at a height of thirty or forty feet. The rugged bark was dotted all over with *lunators*, often massed in rows or patches, so that there must have been several hundred upon the tree, forming an unusual and most interesting spectacle. The great majority were females, but a number of males were also present. While I was consigning to my bottle a few specimens, a large woodpecker settled upon the opposite side of the tree and began to rapidly thin the ranks of the helpless insects, whose mission, like that of the woodpecker, is the destruction of wood-boring larvæ.

A year later, being in the same locality, I visited this tree and found again a number of ichneumons engaged in the performance of their duty, and also saw sticking out of the bark many ovipositors which had belonged to unfortunate visitors of the previous summer.

Field Notes—1881.

The earth covered by its first mantle of snow reminds one that the collecting season is virtually ended, and the lengthening evenings allure one to the study fireside to go carefully over note books and collections and to read the recorded labours of fellow Entomologists.

A few [memoranda from my own note book may perhaps not be barren of interest to some of the less experienced readers of the *Entomologist.* I find that almost the first insect of spring was the Mud-wasp, *Polestes annulatus*, which appeared with a few flies and spiders about the 15th of March. This wasp is very abundant here, and from the pulverized macadam of the streets thousands of its mud cells are constructed every summer under the window-sills and numerous cornices of the Parliament Buildings, about which the wasps linger until the end of October. Toward the end of March a few bees and a number of small beetles, as *Amara interstitialis*, appeared. *Pieris rapæ*, the cabbage butterfly, was observed on April the 1st, but from this date to the 8th of the month a severe cold spell (thermometer touching zero) reduced insect appearances to the minimum again. At its conclusion they emerged in still greater variety and number; *Vanessa antiopa* flitted about in sunny glades of the wood; *Cicindela purpurea* enlivened the fields, and its relatives, *C. vulgaris* and *C. sex-guttata*, the roads. Mosquitoes came in full force a fortnight later, and on the 24th I obtained a number of Buprestidæ upon young pines, viz., 1 ♂ and 2 ♀ *C. virginiensis*, and 14 ♂ and 13 ♀ *C. liberta.* I was somewhat surprised to find them so early in the year, yet could have taken many more. They were generally paired, in several instances copulating. Some *Pissodes* were also seen, and these were with few exceptions copulating. Great numbers of saw-flies were also upon the pines. A few days later I captured specimens of *A. striata*, and by the beginning of May all orders of insects were well represented. On the sixth *Serica sericea* was abundant on the foliage of wild gooseberry bushes. *Chrysomela elegans* were also unusually numerous, but I could not find upon what it fed. *Platycerus quercus ?* was found eating the buds of maples and other trees. The buds were often completely eaten out, and the beetles hidden from view therein. In some buds a male and female were found copulating. This beetle was new to my collection, but I found them frequently again during the summer when using a beating net. During May the curious larvæ of certain Lampyridæ were often seen in damp woods, crawling on the trunks of trees, such as cedar, or affixed by the tail to the bark, undergoing their metamorphoses in a similar manner to the larvæ of the Coccinellidæ. Some reared at home emerged as *Photinus angulatus.* The larvæ, and to a less degree, the pupæ, emitted a strong greenish glow from two of the posterior segments; the imago being, of course, one of our common "fire flies." Some of the larvæ were thickly covered beneath with small ticks, of a bright vermilion colour, which had their pointed heads plunged between the armoured segments of the larvæ. They were not easily dislodged, but walked rapidly when free. By these little parasites the larvæ were so weakened as to perish before completing their transformations. The warm weather of mid-May brought forth increased hosts of insects, and the sultry air, especially in the neighbourhood of lumber yards, swarmed with Scolytidæ, etc. Toward the end of the month I took a trip, with three friends, to the Wakefield Cave, about twenty miles north of the city; and in my spare moments collected a number of insects in that vicinity. Cicindelidæ especially abounded on the sandy hillside roads, and I captured three species which are rare, or not found about here, viz., *C. 12 guttata*, *C.longilabris* and *C. limbalis.* On my way back I took a speciman of *C. sexguttata* having only two spots (the anterior one on each elytron). Although called Six-spotted Tiger Beetles, very many have eight spots, and specimens with ten spots are frequently taken. In a beech grove at Chelsea, *Ithycerus curculionides* was very abundant; several could be seen on nearly every tree; many pairs were copulating. Where do the larvæ live ? On the 31st of May several specimens of *C. Harrisii* were taken on pine saplings, and *H. Pales* and its long-snouted relatives were in full force. On June 4th, *Saperda vestita*, *Oberea amabilis*, *B. nasicus*, *C. nenuphar*, *A. quadrigibbus*, and many other weevils, elaters, etc., were noted. At an excursion of the Ottawa Feld Naturalists' Club to Montebello (45 miles down the river), on 26th June, I captured 129 species of Coleoptera, a considerable percentage of which were new to me. Carabidæ were particularily abundant under drift-wood and dead leaves on the damp, shady shore, and 35 species were taken. Chrysomelidæ, Elateridæ and Curculionidæ were next in number with 15, 18 and 18 species respectively. After midsummer my opportunities for collecting were few, and my notes correspondingly scanty. I will merely mention the capture at Aylmer and Hull, on Oct. 2, *Aletia argillacea*, the cotton moth; both specimens were in perfect order, not in the least rubbed or worn. In Oct., 1880, I took several specimens about the city, also apparently recently emerged.

ENTOMOLOGICAL NOTES FOR THE SUMMER OF 1881.

By Prof. E. W. Claypole, Yellow Springs, Ohio.

I came only last year on the premises where I am now residing, and though I had a small crop of cherries, they were so badly infested with the weevil *(Conotrachelus nenuphar)* that only a few quarts could be found free from the grub and fit for canning. This year a fair crop was promised, the spring was late and the danger of frost little. I proposed therefore to make war upon the enemy, and as soon as the blossom was over prepared a large sheet of cheese-cloth, and for about three weeks jarred the trees before breakfast almost every morning. As the result, I have now nearly 2,000 weevils peacefully reposing in a bottle, after a composing draught of benzine. Only about 10 per cent of my cherries this year were unfit for use. I carried the war into the orchard, and simply by way of experiment, jarred some of the early apple trees and captured a great many of my enemies. I am more than repaid for my labours both on the cherry and apple trees by the quality of apples, when last year with a larger crop, I only obtained knotty, gnarly fruit. I have this year round, smooth, well shaped apples. I have never heard that anything has been done, at least in this neighbourhood, to trap the weevils on the apple trees. Those who live in the north have no idea of the mischief wrought here by the weevil in the orchards.

A word for the mole. In digging potatoes this year I observed the runs of a mole in all directions through the ground. It was a piece of old sod and very much infested with white worms, the larvæ of the Cockchafer *(Lachnosterna fusca)*. Many of the potatoes had been partly eaten by these worms, but I observed that wherever a mole-run traversed a hill of potatoes no white worm could be found, even though the half-eaten potatoes were proof of his former presence. The inference is fair that the mole had found him first and eaten him, and very likely the mole's object in so thickly tunnelling this piece of ground was to find these grubs.

Now it would be very easy to trump up a charge against the mole on the evidence of these facts. There was the "run" which nothing but a mole could make, and there were the gnawed potatoes; put the two together and kill the mole. Many a man has been punished on less conclusive circumstantial evidence. But it is perfectly easy to distinguish the work of a mole from that of a white worm, if one will only take the pains. I have many times found the latter coiled up in the potato he was eating, but I have never seen the mark of teeth such as the mole possesses on a potato. Nor do I believe the mole ever meddles with potatoes, or corn.

Abundance of Certain Insects.—The Southern Cabbage Butterfly *(P. protodice)* is exceedingly abundant here this summer. I have been able to count scores on the wing at one time.

The potato worm, or larva of *S. 5-maculata*, is troublesome on the late potatoes this month (September) and soon strips a plant of its leaves. However, he is easily dealt with, as he is at once betrayed by the castings on the ground, and a little "poison-dust," such as I use for the beetle, soon makes an end of him. I have tried "Buhach" on this insect, but find the former much easier of application and more effective. The latter diluted with ten parts of flour had little effect on the worms, but when used neat it stopped their feeding and killed two of them in a couple of days. But there is the trouble of looking up the creature (green on a green ground) in order to put the powder "where it will do the most good," whereas one need only shake the powder-tin over the plant and pass on, leaving the worm to poison itself.

The same is true of the Cabbage Butterfly *(P. rapæ)* in the early stages of growth of the cabbage. I have used Buhach, and a friend of mine is now using it on a plot of 8,000 heads of cabbage, but the time spent in finding the green worm on the green leaf is a serious drawback, and while the plant is very young I prefer using the "poison-dust." I can sprinkle a whole bed while I am finding the worm on a dozen cabbage heads in order "to put salt on his tail." The "poison-dust" to which I refer is made by mixing one part of London Purple and sixty parts of ashes and passing the mixture several times through a fine sieve. I may add that I find this a very efficient remedy for the turnip fly.

NOTES ON LAST YEAR'S COLLECTING.

By J. Alston Moffat, Hamilton, Ont.

No one I think can have been long engaged in collecting insects without having noticed the remarkable diversity in the products of different years, not only in quantity, but in kinds. Each summer seems to bring its own particular species to the front, so that if a person wishes to get a moderately correct idea of the insects of any locality, it is necessary for him not only to hunt diligently all the season, but every season for a considerable length of time; and if he has from any cause missed one, he may be sure he has missed something which it may be years before he will again have an opportunity of securing, or securing in the same abundance. The causes of these variations seem as yet to a great extent a mystery.

Insect hunting could not be said to be good in this locality last summer. It might be considered very poor, pet it produced its new things for the collection, and some things in plenty which had hitherto been scarce. On the 12th of May I came across some specimens of a Pieris which I thought were poor specimens of *oleracea,* but which Mr. Edwards determined to be *Virginiensis.* On the 23rd I took a very attractive Chrysomela, which is in the Society's Coll. in London as *C. labyrinthica,* but which the authorities say is *multiguttis* of Crotch's Check List, of which *scalaris* is synonym. Rather remarkable, surely, that so handsome and distinctly marked an insect should not have a name of its own. Its season lasted about four weeks, during which I secured over a dozen. I took one specimen of *Stenosphenus notatus* Oliv. Of this species I captured in May, 1879, three specimens, the first I ever took, and that year, a week or two previous to my captures, I received from Mr. Reinecke, of Buffalo, a pair labelled Dallas, Texas. They are exactly similar. The Cerambycidæ were ten days later than usual this year. *Goes debilis* was numerous, and I took my first and only specimen of *S. pulcher.* *Saperda discoidea,* although never plentiful, is interesting from the great difference in size and the markings of the sexes. I had always found two or three females to one male until last season, when the males were most numerous. There were several species of Leptura quite common, especially *vibex,* which I had not seen before. *Gaurotes cyanipennis* was in great abundance, but although you could bring a dozen down with one stroke, you might not secure more than two or three, they were so quickly on the wing again. The months of July and August were barren of anything worthy of note. In the second week of September the fall moths began to appear, and up to the end of October were quite plentiful. Those attractive genera, Scopelosoma and Lithophane, were more fully represented than I had seen them since the fall of 1877, when I took eight or ten species for the first time. A few *S. Graefiana* and *L. Bethunei* can be found every year, but *Scopelosoma Pettiti* and *ceromatica,* and *Lithophane semiusta, pexata, signosa, petulca, querquera,* are rare. Some of these choicer species were easily secured again last fall. I also took one new to me, *L. ferrealis,* whilst a friend here, Mr. J. Johnston, took *S. tristigmata* and *L. cinerosa*, which we were enabled to identify through the kindness of Mr. R. Thaxter, of Cambridge, Mass. Mr. Kyle, of Dundas, secured *L. Georgii*, which I have not yet met with. It may be worthy of note that Mr. Johnston took a specimen each of *Plusia striatella* and *Chærocampa tersa*, the first taken here of either species.

Mr. Thaxter kindly determined the following for me:

Dryopteris rosea,	Hadena Miselioides,
Limacodes inornata,	Dianthoecia meditata,
Gortyna cerina,	Orthodes cynica,
Calledapteryx dryopterata,	Paristichtis perbellis,
Mamestra eloniplina.	

The last four were taken the previous year at Long Point.

THE DEVELOPMENT OF ATTACUS LUNA.

On the evening of the 12th of April, being at the residence of Mr. J. Johnston, a noise proceeding from his hatching box attracted his attention. Upon looking for the cause, he found a Luna just emerged, the fifth from a batch of nine cocoons which he had raised from the egg. Its body and wings seemed to be quite dry, and were a pure downy white, with the exception of the costal band, which appeared disproportionately large, and a minute dark spot for the eye spot. This beautiful moth is well represented in figure 14. It was remarkably active and did a great deal of rapid travelling before it came to rest, which it did at last quite suddenly on the end of a twig, and then never moved except to better secure its foothold. Mr. Johnston placed it in a suitable position under the full light of the lamp, that we might watch its progress to maturity. The first change noticed was the appearance of a bright green spot near the

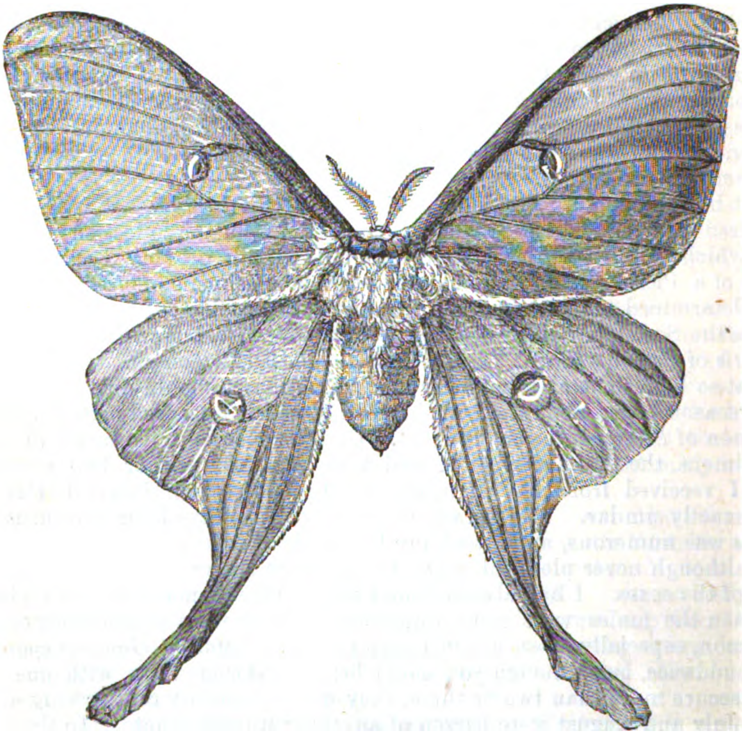

Fig. 14.

base of the front wing, and as that enlarged the wing expanded, very slowly at first, but more rapidly as it increased in size, the green colouring matter flowing along between the upper and lower membrane of the wing, becoming more delicate in its shade as it spread first along the front of the wing, and had reached the apex before it extended through the inner half; but by the time it had touched the extremity of the whole outer angle the size, form and colour of the wing were complete.

In the meantime the hind wing had not yet doubled its original size, with the part from which the tail was to come showing as a slight break on an otherwise even edge; the same routine was followed in the development of the hind wing as that of the front, and by the time the broad part of the wing had attained its full size, the tail was a little more than half an inch long and very much crumpled. This was the last part to expand, but as the fluid passed into it, it also took size and form. The whole time occupied in the operation, from first seeing it until it was completed, was about an hour and three-quarters.

For the benefit of those of our readers who may not be familar with this insect in its earlier stages a larva nearly full grown is shown in figure 15. It is a very handsome caterpillar of a bluish-green colour with a pale yellow stripe along each side of its body, the spaces between the segments traversed by lines of the same colour and each ring adorned with small pearly warts from every one of which arises a small cluster of short hairs.

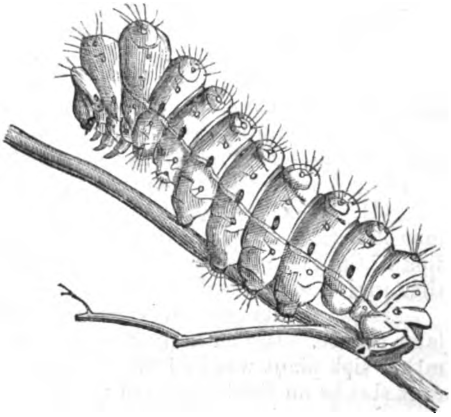

Fig. 15.

Experiments with Yeast in Destroying Insects.

By Dr. H. A. Hagen, Cambridge, Mass.

We are indebted to Dr. H. A. Hagen, of Cambridge, for the following letter and the subsequent remarks on this interesting subject:

Kingsnorth, Ashford, Kent, Dec. 27, 1881.

Dear Sir,—I beg to thank you very much for your letter, dated Nov., 1880, respecting the application of yeast for destroying insect pests. During the past season I have endeavoured to follow the instructions contained therein, and as you express a wish to hear of my success or failure, I will attempt to describe my experiments as clearly as possible. As soon as Aphides became noticeable, I procured some German compressed yeast, dissolved an ounce in a little warm water, added a little coarse sugar, and set it to ferment. In about twenty-four hours I added sufficient water to make up a gallon, and with this syringed a cherry tree attacked by black Aphides. This was on the 16th of June. Four days later I found the tree almost clear of living Aphides, though their dead bodies, or cast skins (I could not ascertain which, although I asked the assistance of an entomological friend) smothered many of the leaves. One remarkable point in this experiment was that a small branch of the tree, loaded with Aphides, hung over a window, and, at the request of my wife, I abstained from syringing it. Here the insects remained perfectly healthy, and after a few days were seen to work down the tree and attack the young shoots that had been washed clean. On June 29th I again dressed the tree, and this time destroyed or drove away every Aphide. I may add that the larvæ of several Aphidivorous insects were present on the tree, and did not appear greatly affected by the application. Encouraged by the apparent success attending the application, I commenced operations, June 20, on a second cherry tree. This, however, was heavily leafed, and I could not make so much impression, but they evidently did not like

the dressing, for they disappeared entirely soon after the second application. I also tried the yeast for Aphides on Guelder Rose (Viburnum), Elder (Sambucus), Field Bean, and some other plants; also for Currant Grub, but could make no decided mark anywhere. With respect to the Currant and Gooseberry Grubs, the liquid ran from off their bodies clean, and I found it almost impossible to saturate them with it. If the syringing was persisted in, they would release their hold and fall to the ground, but very shortly crawl up again. To conclude, I was delighted with the apparent success of my first experiment, but all subsequent trials were so discouraging that I fear yeast is too uncertain in its action to supersede many of the washes we have already in use. Again thanking you for your kind letter, I beg to subscribe myself, sir,—Yours most respectfully,
THOS. H. HART.

To Dr. H. A. Hagen, Cambridge, Mass., U. S. A.

This interesting letter by Mr. Thos. H. Hart, who owns nurseries and greenhouses, allows the following conclusions:

I. It is doubtless true that in the experiments of June 16 and 20, the Aphides were killed, as upon the branch not syringed they remained in perfect health.

II. It is doubtless true that the later experiments were a failure.

III. It seems evident that the yeast has not contained Isaria, or other fungi obnoxious to insects, to which the first success could be ascribed; otherwise the later application of the same fluid ought to have had the same effect, or even by the multiplication of the fungi, a more marked effect.

Experiments made in Germany and here had exactly the same result, first success, later failure. In Germany it was made on a jasmine, in a flower pot, and the previously rather sick plant was in 1881 in good health and perfectly free of Aphides. Some currant shrubs on the left side of my house were entirely free through the whole year (without fall generation) after the experiment, though similar shrubs on the right side of my house were badly infested with currant worms; I had here purposely not applied yeast. After all I believe it can be concluded that a *certain stage* of the yeast solution is needed to make it effective, and that after this stage it becomes indifferent. That yeast solution has killed insects seems to be undoubtedly proved, and it remains only to find out the stage in which its application is successful. It is sure that success, even in a small number of experiments, cannot be annihilated by failure in other experiments.

THE CABBAGE BUTTERFLY, *Pieris Rapæ*, IN NEBRASKA.

BY G. M. DODGE, GLENCOE, DODGE CO., NEB.

I am sorry to note the appearance of *P. rapæ* in Nebraska. August 3rd, 1881, I first saw a living specimen; needless to add that it was busily engaged in a cabbage patch. Others soon appeared, and before cold weather set in it had become quite abundant and larvæ in an advanced stage of growth were found in November. Probably the butterfly crossed the Missouri in the summer of 1880. We are here thirty-five miles west of the river, a distance that could hardly be traversed in one season. It also appears that the cabbage crop has been almost totally destroyed in the eastern part of Dodge County and farther east, while here a partial crop has been secured notwithstanding the visit of the imported pest, supplemented by an unusual abundance of the Cabbage Plusia. August 1st, 1873, when I left my former home in Bureau County, Illinois, *rapæ* had not yet reached that place; therefore in less than eight years its westward progress upon this parallel has taken it across the State of Iowa and the Mississippi and Missouri Rivers.

The question naturally arises—Will the insect stop short when he reaches the grassy plains of Western Nebraska, or will it press onward to the cabbage gardens of Utah and the Western slope? By the aid of man it might soon cross the plains, even if it subsisted wholly upon cabbages; but being not averse to other cruciferous plants, it will find its way made easy. A mustard-like plant of this family with pink flowers grows along the embankment of the Union Pacific Railway, nearly if not quite throughout the whole distance from Omaha to Ogden. At Ogden Junction it is the most abundant of wild plants. If this plant furnishes a suitable food, *P. rapæ* will have little difficulty in surmounting all obstacles that bar its progress toward the valley of the Salt Lake.

LEAF-MINING ANTHOMYIDÆ.

BY J. A. LINTNER, ALBANY, N. Y.

Among our American species of Anthomyidæ, none have hitherto been known as leaf-miners. Several are depredators on the roots of garden vegetables, as indicated by the specific names of *Anthomyia ceparum*, *A. brassicæ* and *A. raphani* (the onion fly, cabbage fly and radish fly); some occur in excrementa, and one, a few years ago, was discovered as preying upon the eggs of the Rocky Mountain locust. During last year and the preceding a species *(A. betæ)* which had been almost unknown since its publication in 1860, has been seriously damaging the leaves of beets in England, by mining them in tortuous channels and large blotches, causing them to shrivel, dry up and die. In two counties alone, 1,624 acres of mangolds were infested (Ormerod). This last summer some Anthomyiæ larvæ were discovered by me in Middleburgh, N. Y., extensively mining the leaves of the garden beet *(Beta vulgaris)*. Judging from published descriptions and figures, I believed it to be identical with the European species of the same habits, and that it had been a recent importation thence. Examples of the eggs, larvæ, puparia and flies were sent by me to Mr. R. H. Meade, of Bradford, England, who has been recently making special study of the Anthomians, and particularly of the North American species, as may be seen in a paper in the March number of the last volume (xiii) of the CANADIAN ENTOMOLOGIST, giving the result of his study of the collections in this family, belonging to the Museum of Comparative Zoology at Cambridge, Mass. Mr. Meade finds, among the examples which I sent to him, reared by me from my larval collections at Middleburgh, no less than three distinct species—all differing from *A. betæ*—two believed to be undescribed—and one identified as *Chortophila floccosa* Macq. It seems somewhat remarkable that all these should have been obtained from larvæ feeding at the same time, upon a small garden bed of beets, containing about fifty square feet of surface. The description and general history of the new species will probably be given in my forthcoming Annual Report.

MIGRATION OF DRAGON-FLIES—*Aeschna heros** (Fabr).

BY A. H. MUNDT, FAIRBURY, LIVINGSTON CO., ILL.

On the evening of August 13th, 1881, I observed them between the hours of five and seven o'clock. The air for miles around seemed literally alive with these dragon-flies, from a foot above ground to as far as the eye could reach, all flying in the same direction, a south-westerly course, and the few that would occasionally cross the track of the majority could all the more easily be noticed from the very regular and swift course they generally pursued; but even these few stray ones would soon fall in with the rest again. Very few were seen alighting, and all carefully avoided any movable obstacles.

The next day very few were seen on the prairies, and these mostly of another species very abundant in this country—*Anax junius* (Drury)—which were probably at home previously, and in a few days I could see none others but the latter. A few newspapers, and also a few correspondents from twelve to fifteen miles east and west of here, had observed and mentioned their flight. Although their course was precisely in that direction, Prof. Forbes, of the State Normal Museum, writes that "no observations had been made there regarding the migrating of this insect," and he kindly identified the last-named species for me; however both have been carefully looked up and identified as being separate, by other well informed Entomologists, all agreeing with me that the above names are correct.

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* { *Œschina heros*, Fabr.
{ *Æschna.*

Whether their migrating was instinctive, or forced by the Manitoba wave, then reported in Chicago papers as having arrived in that direction, after a spell of very warm weather; or caused by the dry season, the ponds having become so exhausted as to afford no pasturage for their larvæ, seems a matter of conjecture: most likely the latter, however, as the cold wave reached here but very slightly.

BOOK NOTICES.

The Hessian Fly, its ravages, habits, enemies and means of preventing its increase, by A. S. Packard, jr., M.D.; being Bulletin No. 4 of the Department of the Interior, U. S. Entomological Commission, 8vo., pp. 43, illustrated by two plates containing many figures, one wood-cut and a map.

A synopsis of all that has been published in reference to this destructive insect, with such additional facts as the members of the Commission have been able to collect.

A Treatise on the Insects Injurious to Fruit and Fruit Trees in California. By Matthew Cooke, Chief Executive Horticultural Officer; 8vo., pp. 72.

This useful pamphlet treats of the Codlin Moth, which has now taken up its permanent residence in California, making apple and pear growing in some sections very uncertain; the Pear Slug, the Red Spider, the Tent Caterpillar, Currant Borer, and several species of Scale Insects which attack the apple, pear, peach, plum, orange, etc., illustrated by a number of wood-cuts. It appears that our California friends are now seriously affected by insect pests, from most of which they had until of late been free. The fruit interests of this State are so highly important that very active measures are being taken to keep these insect pests within bounds, and an Act has been passed by the State compelling the general adoption of such remedial measures as shall from time to time be found of value. We shall watch with interest the effect of such legislation, and sincerely hope that it may result in a marked abatement of the evils complained of.

Bulletin No. 7 Insects Injurious to Forest and Shade Trees. By A. S. Packard, jr., M.D. Issued by the Department of the Interior, U. S. Entomological Commission; 8vo., pp. 275, with 100 illustrations.

The object of this Bulletin, as stated in the introduction to it, is to give to the public a brief summary of what is up to this time known of the habits and appearance of such insects as are injurious to the more useful kinds of trees. Beginning with the insects injurious to the various species of Oak, the author treats of those which injure the Elm, Hickory, Butternut, Chestnut, Locust, Maple, Poplar, Linden, Birch, Beech, Tulip Tree, Horse Chestnut, Wild Cherry, Ash, Alder, Willow, Pine, Spruce, Balsam, Juniper, Tamarack, Arbor Vitæ, and others. A large proportion of the work is occupied with descriptions of those insects which injure the more important forest trees such as the Pine and Oak. This is a most useful synopsis of our knowledge in this department, and its issue will no doubt greatly stimulate the progress of Entomology in this practical direction, for while it shows that much has been done in some of the most important departments, in many others our knowledge is extremely scanty. This work is conveniently arranged, and like the other works of this distinguished author, well written in a plain and popular style, and will commend itself to all who are interested in preserving our forests and useful shade trees from destruction by insect foes.

(A FRAGMENT OF A) GUIDE TO PRACTICAL WORK IN ELEMENTARY ENTOMOLOGY. An outline for the use of students in the Entomological Laboratory of Cornell University, by J. Henry Comstock; 8vo., pp. 35.

This work is divided into two chapters, the first of which treats of the terms denoting the position and direction of parts in insects, the second of the external anatomy of a grasshopper, *Caloptenus femur-rubrum.* A useful guide to all those entering on the study of Entomology.

TENTH REPORT OF THE STATE ENTOMOLOGIST OF THE NOXIOUS AND BENEFICIAL INSECTS OF THE STATE OF ILLINOIS. By Cyrus Thomas, Ph. D.; 8vo., pp. 244, illustrated with two plates and 79 wood cuts; containing articles on the army worm, *Leucania unipuncta;* a new Corn Insect, *Diabrotica longicornis;* the Relation of Meteorological Conditions to Insect Development; Descriptive Catalogue of Larvæ; the Larvæ of Butterflies and moths; and the Hessian Fly.

This Report contains much that is new in reference to these several subjects, and is a valuable contribution to Entomological literature.

A BIBLIOGRAPHY OF FOSSIL INSECTS. By Samuel H Scudder, 8vo., pp. 47.

A complete list up to the present time of all known works and papers on fossil insects arranged in alphabetical order.

SYNOPSIS OF THE CATOCALÆ OF ILLINOIS. By G. H. French, Carbondale, Ill.

Contains references to fifty-eight species, followed by instructions for capturing Catocalæ, 8vo., pp. 11, with one wood-cut.

REVISED CHECK LIST OF NORTH AMERICAN BIRDS, with a Dictionary of the Etymology, Orthography, and Orthoepy of the Scientific Names. By Dr. Elliot Coues; lge. 8vo. Estes & Lauriat, Boston.

Such a book from such a pen cannot fail to come into the hands of a great many Ornithologists, and the circulation of so valuable a work will greatly tend to render this much neglected part of the science more widely studied and understood. The first part of the book is devoted to notes and general explanations on Etymology, Orthography and Orthoepy. The second part contains the Revised Check List proper, and on the latter part of each page the names divided into syllables and marked for pronunciation and accentuation, with copious notes on the derivation. In regard to the nomenclature, the author has in many instances in this work taken a stand opposed to that of some eminent Ornithologists of the present day, which is much to be regretted in view of the desirability of uniformity in this matter. The printing is excellent, and done on fine heavy paper, and the proofs have evidently been most carefully read, altogether forming a very attractive volume and a valuable addition to the Ornithologist's library.

ON LUMINOUS INSECTS.*

BY GEO. H. BOWLES, MONTREAL.

Scattered here and there throughout the Organic world we find certain species possessing the remarkable power of giving light—not the light generally associated with the phenomena of combustion, but usually a mild phosphoric glowing or sometimes a succession of brilliant coloured flashes.

One of the most familiar instances of luminosity, is that which is due to the mycelium of fungus pervading decaying substances such as wood, peat or fermenting leaves.

The light is often seen at night in damp places in the woods and by the side of lanes. It usually proceeds from old roots or stumps, the substance of which, during the day, presents a whitish yellow appearance, but at night, throws forth a mellow, ghostly light, quite startling when first seen.

Besides the humble fungi, several plants in the higher groups are said to be luminous. The daughter of Linnæus in 1762 noticed radiations of light proceeding from a cluster of garden Nasturtiums (Tropælum Majus). This appearance has also been observed in the Marigold, Poppy, and other plants as well as in certain mosses.

In the lower orders of the animal kingdom, luminosity is not uncommon. That beautiful phenomenon, a phosphoresent sea, is generally ascribed to the presence in the water of innumerable multitudes of microscopic beings termed *Rhizopoda.*† As we rise higher in the scale numbers of creatures are found endowed with this remarkable property,‡ and when the class *Insecta* is reached, we see species provided with a luminous preparation, which fully equals in proportion to size, the light given by our common modes of over-coming darkness.

It would be hardly right to overlook the Centipedes, though not true insects, as one species at least is capable of diffusing a very strong light. This species, *Scolopendra electrica,* is found in England, and is by no means uncommon. Though its light is seldom seen, in consequence of its living in holes, or under clods of earth. The light proceeds from the whole body, not being restricted to certain parts as in insects. Other species of this genus are said to be luminous. One described by Linnæus S. phosphora is a native of Asia.

Among the true insects the most familiar examples are our common Fire-flies, belonging to the family *Lampyridæ Leach.* These little creatures may be seen in great numbers on warm summer evenings, especially in marshy places. The perfect beetle is soft and flat, with a horny, semi-transparent shield projecting over the head. The light-producing organs are situated in the three last segments of the abdomen, and are of a light sulphur colour. Patches of this colour also extend on either side of the head beneath the over-hanging Thorax. When the insect is taken in the hand a constant gleam of light proceeds from the abdominal glands, whether it comes from the head too is questionable.

When on the wing the light is intermittent, flashing for a second and then being extinguished, appearing again shortly in another place as the insect flies.

The genus *Photinus* includes the greater number of our luminous species. The females are provided with wings unlike certain foreign *Lampyridæ*, and both sexes equally possess the power of giving light.

Phosphorescence has been noticed in the larvæ of several American Fire-flies. Specimens of *Photuris pennsylvanicus (DeGeer)* have been found to emit a brilliant light from their anal segments,§ and it is not unlikely that many, if not all, of those that possess the property in their perfect state have it, though, perhaps, in a less degree in their early stages.

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* A late article in the English *Mechanic* Vol. XXX, p 559, states that a fungus *(Agaricus Pleurotius emerici u. e.)* has been found in the Andaman Islands, the entire substance of which is luminous. The specimens were quite young and scarcely fully developed.

† One in particular, *Noctiluca Miliaris.*

‡ *Polypes, echinoderms, medusæ, &c.* Even the common earth worms are said to evolve a shining light.

§ *Canadian Entomologist,* Vol. I, p. 39, and Vol. II, p. 38.

The light-giving *Lampyridæ* are represented in Great Britain by the common English glow-worm *Lampyris Noctiluca.* This species has so often been described that its general characteristics are well known to every one. It is common in the south of England, but is rare in the northern parts, and Scotland. The perfect insect is herbivorous, feeding only upon the tender leaves of plants; but in the larval state they are voracious in their habits, devouring snails, slugs and soft-bodied insects.

It is slightly luminous in its preparatory stages. But the perfect female alone can be said to possess the property to any extent. Indeed it was formerly supposed to be peculiar to this sex, but the male has now been ascertained to give a feeble light.

Lampyris Italica,* though truly a continental species, is taken occasionally in England, both sexes being luminous.

Another *Coleopterous* family, the *Elateridæ*, contains species endowed with the property of light emitting in a much greater degree than *Lampyris*. The members of the genus *Pyrophorus* are natives of the South, and like all " Click-beetles," are dull sombre-looking creatures, of moderate size.

Pyrophorus noctilucus is a dark, rusty, brown beetle, about an inch and a half long. A native of the West Indies and Central America. Figure 16 represents this interesting insect both at rest and on the wing. The light chiefly proceeds from the transparent, eye-like spots on either side of the thorax. A fainter light is also said to come when the insect is flying from two patches beneath the body, but according to Kirby and Spence this is incorrect. They say: " There is a luminous patch in the posterior and inferior region of the metathorax, in a somewhat triangular and depressed cavity, ordinarily concealed by the elytra, but when these are expanded in the act of flying, giving out a more considerable, but more diffused, light than the thoracic reservoirs; in fact, the whole body is full of light, which shines out between the abdominal segments when stretched, and being strongly reflected by the two basal abdominal segments, gives an

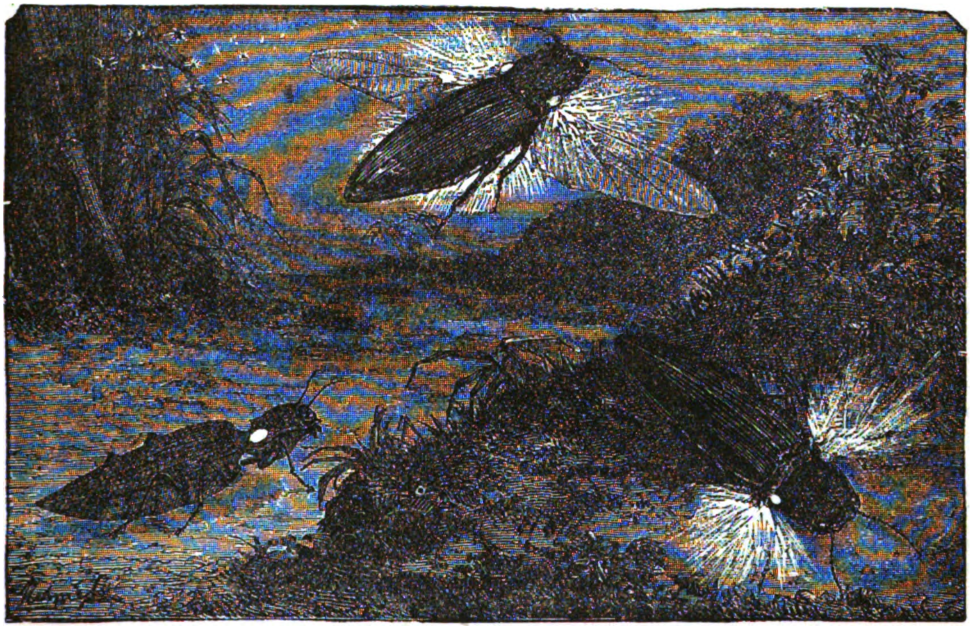

Fig. 16.

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* General Zoology, Shaw, 1806, Vol. VI., part I, p. 77-78.

appearance of the two luminous patches there, which DeGeer has described, but which do not actually exist.*

These elaters, we are told, are used by the natives of the tropic countries where they are found, as lamps, enabling them to perform their evening household duties by their light, as well as for purposes of decoration. Brazilian ladies, at the present day, fasten them in their hair as ornaments.

Many other luminous elaters are found all the way from the Southern States to Chili; but of their occurrence in the perfect state as far north as this, I have not been able to find any record—though in the early numbers of our journal, the *Entomologist*,† mention is made of the capture in Ontario of a luminous larvæ supposed to belong to the *genus Melonactes*. Unfortunately it was not reared to the imago, and the species to which it belonged is therefore in doubt.

Several other species of *Coleoptera* are thought to be luminous. *Buprestis ocellata*, is described as emitting light from the ocelli in its elytra; and one of the Longicorn beetles (*Dadoychus flavocinctus*) allied to *Saperda*, is supposed to have phosphorescent organs in the third and fourth segments of its abdomen.‡

Besides the *Coleoptera*, another insect order is said to contain luminous species. I mean the order *Hemiptera*. To one of its families, *Fulgoridæ Leach*, belong two insects that are stated to be in possession of luminous properties far exceeding those of the insects before described.

The best known of these insects, *Fulgora lanternaria*, was first described by Madame Merian in her work on the "Insects of Surinam." She states positively that she herself saw numbers of these lantern-flies§ shining at night with great brilliancy, and that the light proceeding from one of them was sufficient to easily read a newspaper by.

The accuracy of this statement has been questioned by many writers. An experienced Entomologist, who resided for a number of years in Surinam, denies that the insect gives any light whatever, while some of the residents declare that it does,‖ and others again that it does not. Kirby and Spence think that "these contradictory statements may be reconciled by supposing that one of the sexes is luminous and the other is not." ¶

It is not unlikely that the luminosity may be merely occasional, perhaps being limited to particular seasons or the time of pairing. At any rate the subject requires further investigation before a decisive verdict can be given either way.

The other species is a native of China, and is called the candle-fly (*Fulgora candelaria*). Of its luminosity there is still greater doubt than of that of the American species. By some it is supposed to be the insect collected by a species of "*ploceus* or weaver bird to decorate its nest, to which they are attached by means of clay, whether for the purpose of food or light remains to be proved." **

Other insects, besides those already enumerated, have been stated by various writers to be luminous. Kirby and Spence mention the case of a country-man pursuing a "Jack o' lantern," which being captured turned out to be a mole-cricket (*Gryllotalpa vulgaris*, *Latr.*),†† and in another instance a farmer describes a luminous object which he knocked down as being exactly like a "Maggy long-legs" (*Tipula Oleraceæ*).‡‡

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* Kirby and Spence—"Introduction to Entomology," London Ed., p. 540.

† *Canadian Entomologist*, vol. 1, p. 2 (a full description is given). Also see Annual Report of Entomological Society of Ontario for 1872, p. 74. A luminous larvæ is mentioned by Baron Osten Sacken as being taken at West Point, N.Y.—described and figured Proceedings Entomological Society, Philadelphia, 1862, p. 125, Pl. 1, fig. 8.

‡ Kirby and Spence—p. 542.

§ *F. lanternaria* is called by the Dutch "scare-sleep," from the noise it makes towards evening. It is also called "porte-lanterne," or "lantern-bearer."

‖ It affords "sufficient light for almost any purpose"—See "Narrative of a Five Years' Expedition Against the Revolted Negroes of Surinam," Capt. J. G. Stedman, vol. 2, p. 37.

¶ Kirby and Spence—p. 543.

** "Nat. His. of Insects." New York: Harper Bros., 1840—p. 130.

†† Kirby and Spence—p. 544. ‡‡ *Ibid.*—p. 546.

This would lead us to suppose that other common and well-known insects may be found to possess the property on investigation.

Kirby and Spence suggest that in some cases phosphorescence may be caused by disease, they also think that light giving insects may in part explain the mysterious phenomena of *ignus fatui.*

With regard to the use of the light to its possessor opinions are divergent. In the case of the *Elateridæ*, one theory is that it may serve to defend them from their enemies by alarming them,* and this may not be far from the truth, as an animal would require a great deal of pluck to swallow one of these specks of living flame.

Its purpose in the lantern-flies it would be rash to conjecture until the fact of their luminosity is fully proven.

Even of its use in the *Lampyridæ* little is known. The most satisfactory explanation, more particularly applicable to *Noctiluca*, is that it serves to direct the male insect to the abode of its wingless mate.

But with our American species this explanation hardly holds good, as both sexes can fly, besides being equally luminous.

I haye seen it stated † that the *Lampyridæ* are distasteful to many insectivora. May not the light then serve as the brilliant colours of some caterpillars are supposed to do, as a warning of their offensiveness to creatures that would devour them? thus deterring the insect eater from swallowing an unpalatable morsel, and at the same time protecting these soft-winged beetles better than the shelly armour of most other members of their order.

The light in the *Lampyridæ* and *Elateridæ* has been ascertained to proceed from a soft, yellow substance, thickly permeated with air tubes, which is closely applied to the transparent parts of the body through which it is seen.

In the glow-worm, besides this substance, there are two small oval sacs, formed of a fibre wound spirally, as in the tracheæ, which contain a yellowish matter capable of affording a more powerful and permanent light than that of the adjoining parts.

Until lately the cause of insect luminosity was supposed to be the combination of some phosphoric matter in combination with the oxygen inspired by the animal. But latterly investigators have ascribed it to physical rather than chemical action, and it is now thought to be explained by the vibratory or undulatory theory of light. Rapid molecular vibrations, set up by the action of light-waves in the particles of a phosphorescent body, are supposed to be communicated to the theoretical ether which is thought to fill all space. The principle being that these vibrations produce light as the vibrations of air generate sound.

To enter more fully into this question is not in the scope of the present paper, nor is it, strictly speaking, in the domain of the Entomologist, still the subject is one that may profitably occupy our leisure moments during the coming summer, and those of our members who possess powerful microscopes may do good service by examining the phosphorescent organs of insects and giving us the result of their investigations. The field is almost unexplored, and as yet we have to confess our ignorance of the causes which produce many of the phenomena that I have but touched upon.

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* Kirby and Spence—p. 549.

† I think by Mr. A. R. Wallace, in *The Contemporary Review.*

HOUSE-FLIES.

W. Hague Harrington, Ottawa.

It will be necessary to define what a fly is, for the name is very commonly applied to many insects which belong to very different orders. We have, for instance, saw-flies, butter-flies, fire-flies, dragon-flies, and shad-flies, belonging respectively to the *Hymenoptera*, *Lepidoptera*, *Coleoptera*, *Neuroptera.* All of these have four wings, in common with the majority of insects; whereas the true flies have only two and constitute the order of *Diptera*, which name is formed from the Greek words *dis*, twice, and *pteron*, a wing. Although the order is not generally a favourite one with Entomologists, its study will reveal a great many curious and important facts in connection with insect life. Its members are not so handsome nor as large as those of the *Lepidoptera* and *Coleoptera*, nor do they construct complex dwellings like the *Hymenoptera*, yet their larvæ are found living under the most varied and wonderful conditions, and not unfrequently greatly affecting man's welfare, as do often also the perfect insects.

All insects (by the classification used in this country) are divided into seven orders according to the character of the wings, and these orders are again arranged in two series—one having mouth-parts adapted for biting and masticating their food, the second having the analogous parts modified to form a sucking apparatus. The *Diptera* belong to the latter.

It has been estimated that there are about 10,000 species of flies indigenous to North America, of which not more than one-fourth have been described, so that plenty of material yet remains for investigation, and doubtless many new species would reward an industrious collector in any section of Canada.

No other insects, perhaps, occur in such profusion as do flies. As soon as the first mild days arrive, clouds of small gnat-like forms appear, and as the season progresses new species are continually emerging. At times the air seems literally full of these minute beings, which swarm alike in woods or over fields and waters, very frequently making their presence felt as well as seen.

In the larval state they occupy a very important place in the economy of nature, and while some species—such as the hessian-fly and wheat-midge—are most inimical to man's interests, the majority subsist by destroying substances which otherwise might remain to infect and contaminate the air. The aquatic species—such as the black-flies—live principally on decaying vegetable or animal matter in the water, while the greater numher of terrestial forms subsist upon similar substances, which they rapidly consume.

So rapidly does this consumption proceed that Linnæus, referring to the flesh-flies, stated that three of them with their progeny could eat up a dead horse as quickly as a lion could.

Notwithstanding that house-flies abound everywhere, or at least where man has his habitation, comparatively few persons know the most simple facts concerning their life-history and transformations. Even among Entomologists there is much of vagueness in regard to these matters, owing partly to few having fully investigated the habits of the house-fly, and partly to its being often confounded with allied species. There appeared last year, in a popular magazine, an article taken from "Science Gossip," and professing to treat of the development of *Musca domestica*—as the house-fly is named by Entomologists—in which it was stated that the larvæ were reared in meat upon which the fly had deposited its eggs. This shows at once that the description was really that of the development of one of the meat-flies; for, so far as I am aware, the house-fly has never been known to deposit its eggs upon meat.

The house-fly of this country is now known to be identical with that of Europe, although the late Dr. Harris described it under the name of *Musca harpyia.* Even in Europe but little attention has been given to its habits since its name was bestowed upon it by Linnæus.

Packard, writing in 1878, stated that there were only three works in which its life-history was given. The first was published by DeGeer, in 1776, and satisfactorily described the various stages, but did not give the time occupied by each. The following is his description of the manner in which he discovered the habitat of the larvæ:—

"In considering the enormous abundance of these domestic flies, which especially appear in the months of July and August, it is astonishing that no person has hitherto discovered their larvæ. I searched uselessly for them myself everywhere during several years, and then it was only chance that caused me to discover them in the same months of July and August of the year 1750, when having, according to the instructions M. de Reamur in the 'Art of Hatching Domestic Birds,' made one day a heap of horse manure to hatch some chickens, I saw flying upon and all around it a great number of these flies, which having aroused in me the curiosity to stir up the heap, I found in it abundance of larvæ with the head of a variable form; and having enclosed several of them in a sand-box half filled from this same dung-heap, I observed that some days after they had made cocoons of their own skin, from which came out afterwards true domestic flies, such as those which I have just described. The larvæ of this species live then in manure, but only in that which is very warm and moist, or to say it better, that which is in a complete fermentation, as was that which immediately surrounded the cask in which I hatched successfully some hen's eggs; at least I have never met with them in dry manure nor in the earth."

The second work was published several years later by a German named Keller, and contained excellent figures of the larvæ and pupæ. The third, also by a German named Bonché, appeared in 1834, but the figures in it (copied in the "Guide to the Study of Insects") were drawn so poorly as to be unrecognizable. Packard, not having seen Keller's work, was of impression that the poor figures of Bonché were the only ones published, but I have before me a little book, entitled the "Earthworm and House-fly" (published in 1858 by James Samuelson, assisted by J. Braxton Hicks, M.D., F.L.S., etc.), which reproduces Keller's figures from a copy of his work in the British Museum, and shows us that they were excellent ones. There are also some very fine microscopic illustrations of various parts and organs of the house-fly in the little treatise just mentioned drawn by the author.

As recently as 1878 the transformations of the house-fly had not been given by any American naturalist; but in the autumn of that year Packard worked out its life-history, and described its different stages in a paper published in the Proceedings of the Boston Society of Natural History. This paper was accompanied by a large plate of excellent figures, and to it I am indebted for many of my facts.

Every one has noticed that flies are particularly numerous in the vicinity of stables, and investigations have proved that it is in the decomposing vegetable matters which there accumulate that the eggs of the fly are deposited and that the larvæ live. Keller reared them successfully in a jar of moist decomposing wheat, but the material used by Packard was that which furnishes the majority of flies with a breeding place, viz., fresh horse manure. In the crevices of this substance the fly deposits her eggs to the number of about 120. These eggs are elongate, oval cylindrical; a little smaller and more pointed at the anterior than at the posterior end. Each is from $\frac{4}{100}$ to $\frac{5}{100}$ of an inch long and $\frac{1}{100}$ of an inch in diameter, being slightly smaller than the egg of the meat-fly which we see attached to meat. In colour it is a chalky white, and opaque, so that the earlier embryonic changes cannot be observed, as in the case of many insects having transparent eggs. With suitable conditions of heat and moisture the egg hatches in 24 hours, and there slips out an active, semi-transparent little maggot (as the larvæ of all flies are called) $\frac{7}{100}$ of an inch in length. About 24 hours later the larva, grown too big for his jacket, casts it aside, and now measures from $\frac{15}{100}$ to $\frac{17}{100}$ of an inch, and is slenderer than during the preceding stage. This second stage lasts from 24 to 36 hours, when another moult takes place, after which the larva lives three or four days and attains a length of from $\frac{1}{4}$ to $\frac{4}{10}$ of an inch. The larva has a small conical head, bearing minute, two-jointed antennæ, and below them three small fleshy tubercles—probably representing or foreshadowing some of the future mouth-parts, of which there are now only a pair of black, horny mandibles. The segment immediately behind the head, known as the prothoracic segment, bears a spiracle, or breathing orifice, and others are situated in the anal, or posterior segment.

When the larva is full grown its body contracts and changes in shape, becoming what is known as a *puparium*. That is, the larva does not spin a cocoon in which to pupate, but uses for this purpose its own skin, which becomes detached and hardened, and within which the pupa forms and remains for from 5 to 7 days. This puparium is of the shape of a grain of rice, from ⅙ to ¼ of an inch long, and of a dark reddish-brown colour.

At the end of the time just mentioned the insect frees itself from the pupa-skin and pushes its way out of its case, the anterior end of which splits off at the junction of the thorax and abdomen, and falls back like the lid of a box. On emerging from his bandbox the fly, however, not yet ready to set out on his tour of visits and explorations; his clothes do not fit him comfortably, nor is he yet the trim, natty little chap that we are familiar with. His wings are soft, small and baggy, barely reaching to his waist, and pressed against his sides. He is also pale, indeed nearly white, with perhaps a slightly jaundiced appearance, due to his underground life and recent close confinement in a dark cell. But he walks or runs rapidly about, respiring quickly and strongly, and in an hour or so his wings expand and stiffen, the proper colours develope, and blithe and agile he leaves his lowly birth-place in search of adventures.

Before describing the fly in this final and perfect state, I will recapitulate its life-history as already given.

The eggs laid are about 120 in number, and in about twenty-four hours the larvæ are hatched. There are three stages of the larval state, and consequently two moults. The first stage lasts about one day. The second stage lasts about one day. The third stage lasts three or four days. The entire larval state lasts from five to seven days. The pupal state lasts from five to seven days. The period from the time of hatching to the exclusion of the fly lasts from ten to fourteen days in warm weather.—(*Packard*).

We thus see that from the time the egg is deposited until the fly arrives at maturity only about a fortnight elapses; and when we consider that the fly, unlike many insects, does not die immediately after depositing her eggs, but survives to perform that operation, perhaps, twice or thrice again, it will not be difficult to account for the rapid manner in which the swarms increase toward the autumn. It was calculated by Keller that if a fly deposited eighty eggs, and that only half of these produced females, she might in one season be the progenitrix of upwards of *two millions*. Other authors have arrived at a much larger number as the possible offspring in one season, but the smaller one will suffice to show how rapidly they are capable of increasing.

Although the common house-fly is so abundant, it so closely resembles allied species that it is very difficult to distinguish it from some of them. The structural differences by which entomologists recognize it are those of the mouth-parts, and venation of the wings.

The following is its description as taken from Packard :—

"The body of *M. domestica* is black; the head has a longitudinal, reddish, oval, smooth area on the vertex, with the orbits and adjacent regions golden (or silvery in some lights); the hairs are black, and the antennæ and plume are black; the thorax is black, tinged with golden grey on the sides, with three dorsal, grey, longitudinal bands, the middle one most distinct, the two lateral ones partially interrupted in the middle and continued on to the scutellum; there is a broad, lateral, golden-grey band interrupted by the sutures; the base of the first abdominal segment has a yellowish band interrupted in the middle; on the middle of the end of the two succeeding segments is a triangular, mesial, golden spot, with an oblique, irregular band on each side, and farther down the sides golden; terminal segments golden; base of wings, scales, and halteres yellowish-white; legs black. The male differs from the female in the front between the eyes, being about one-third as wide as in the latter, while she is rather the smaller. Length, ·22 to ·32 inch."

This description, if borne in mind, will assuredly enable you without difficulty to detect the culprit when he pilfers from your sugar bowl, or commits an assault upon your person.

The body of the fly consists of three sections, named respectively the Head, Thorax and Abdomen.

The head bears a pair of large, semicircular compound eyes, each having about 4,000 hexagonal facets, each of which lenses corresponds to a single eye, being isolated from the adjacent ones by a dark pigment, and being connected with the optic nerve. There are also three simple eyes or ocelli, arranged in the form of a triangle upon the top of the head, between the compound eyes. Thus liberally endowed with organs of sight, the fly sees in almost every direction without change of position, and by their aid often escapes an untimely end. From the front of the head spring the antennæ, which are short, being composed apparently of only three joints, but really of six: the third is dilated and much larger than the others, while the fourth, fifth and sixth form a kind of plume. When the insect is at rest the antennæ are folded down at the base of the proboscis, so as to be nearly hidden from sight.

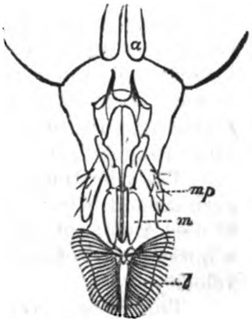

Fig. 55.

The mouth parts are, however the most curious and interesting structures of the head, being modified from the biting or gnawing mandibles of the larva into an organ capable only of sucking up liquids. (See fig. 55). In this proboscis the hard parts, such as the lancets of other flies, are almost obsolete. The maxilla and single-jointed palpi are small, and the short mandibles are of little use, leaving only a fleshy, tongue-like organ, which is bent up under the head when not in use. This tongue, or labium, consists of a tubular bag, formed of thin, transparent membrane, dilated at its extremity into a large sucking disk. This expansion is divided into two broad muscular leaves, supported upon a frame-work of modified trachæ, and presenting a sucker-like surface, with which liquids are lapped up. The modified trachæ which sustains the expanded sucking-disk end externally in projecting hairs, and they give to the fleshy disc the properties of a minute rasp, which is employed by the fly in scraping or tearing delicate surfaces. As Newport states:—"It is by this means that it teases us in the heat of summer when it alights on the hand or face, to sip the perspiration as it exudes from and is condensed upon the skin." With this organ the fly also tastes and sips the delicacies of our tables, for, with the maggots grovelling form, he seems also to a great extent to abandon the lowly and depraved tastes of his youth, and searches thenceforth for sweets and dainties, the pursuit of which often proves fatal to him.

The proboscis of the fly is also fitted for other and more dangerous services, as shown by Dr. Thomas Taylor in a paper, (read before the Montreal Meeting of the A. A. A. S.), on the "House-fly as a Carrier of Contagion." While engaged in dissecting the head of a common house-fly, he noticed emerging from the ruptured proboscis a very minute snake-like animal—a species of anguillula—measuring about eight one hundredths of an inch in length by two one thousandths of an inch in diameter. Subsequent examination proved the sucking-tube of the proboscis to be of sufficient diameter to admit of taking up spores of cryptogams, eggs of trichinæ and anguillulæ, or even the latter animals themselves; thirteen of these having been found in the proboscis of a single fly.

These facts suggested to Dr. Taylor the importance of ascertaining, by experiments, whether flies might not be carriers and distributors of noxious germs. To test the question practically, he placed in a large glass receiver several hundred house-flies and a quantity of the spores of the red rusts of grasses, (Tricholoma) with the following results:

"The flies at first did not seem to esteem the spores as suitable food, but, on the morning of the third day I found that the rust was replaced by larvæ and remains of eggs of the common house fly. The eggs were deposited and hatched between Saturday noon and the following Monday morning, 9 o'clock, or in about forty-eight hours. On the following day I placed in the receiver about a quarter of an ounce of the same description of spores, combined with sugar. The flies partook of this confection, consuming the sugar and most of the spores. In about twenty-four hours after the flies had partak e this mixture I killed and dissected a number of them, and found the small intestines intensely coloured, of a deep reddish orange shade, representing the digested spores of the tricholoma. I observed in the contents a few well defined orange spores, but none of them appeared to have germinated. Fastened between the hairs on the limbs of each of the flies examined I found a number of the spores, and the efforts of the fly to get rid of them only resulted in attaching them more firmly to it. They might, however, be brushed off by objects with which they were brought in contact, while their germinating powers would long outlast the life of the insect itself. It was evident from this experiment that flies were capable of conveying such spores to plants and other bodies. On the other hand, the fact that by far the greater part of the spores were consumed, in the one case by the larvæ of the fly, and in the other (*i.e.* when mixed with sugar), by the fly itself, shows that this insect may destroy microscopic germs as well as disseminate them. and indicates that in some cases its agency in keeping down their number may more than counterbalance its action in contributing to their dissemination."

Having thus briefly and imperfectly considered the organs of the head, we find, on examining the second section of the body—the Thorax—that it bears the organs of locomotion, which consist of three pairs of legs, a pair of wings, and a pair of halteres or balancers. The most important of these are the wings, which are not large, when compared with those of many other insects, yet suffice to enable the fly to sustain a swift and prolonged flight.

The vibrations of the wings during flight are exceedingly rapid,—about 330 strokes each second being the usual rate, when the insect is flying swiftly. Thus the fly is able to dart about with a swiftness surprising in so small a body, and which, if possessed by a horse in ratio to its magnitude, would enable it to traverse the earth with inconceivable velocity.

The *halteres*, *balancers* or *poisers*, as they are indifferently called, are two small club-shaped organs, which occupy the position of the second pair of wings in insects of other orders, and which may be considered as merely modified or rudimentary wings. They are kept in a constant vibration during the insect's flight, which they serve to regulate, as has been proved by experiments. The possession of these little organs enables the diptera to change the direction of their flight far more quickly than other insects, as may be seen by watching the erratic movements of flies hovering in the air. These balancers are more easily seen in some of the larger species, such as the *tipula* or daddy-longlegs, which sometimes enters our houses from the neighbouring fields. In the house-fly, as in many species, they are partially hidden beneath a pair of protecting horny scales, which project from the sides of the thorax.

The legs are divided into five parts, or joints; first, the *coxa* or hip, by which the leg is articulated to the body, then a short, round joint called the *trochanter*, next the *femur* or thigh, then the *tibia*, and lastly the *tarsus* or foot. This latter merits particular attention, on account of its peculiar powers. It is subdivided into five joints, the last of which bears the apparatus which permits a fly to crawl so easily on the most perfectly polished surfaces, even when it is beneath them. On examining the last joint, that bearing the claws, it is found to be expanded into two large *pulvilli* or pads, thickly set with minute hairs or filaments, each of which terminates in a small fleshy bulb, kept moist by a viscid exudation. Although very minute, they are so numerous that the foot adheres firmly enough to sustain the fly in his pedestrian excursions overhead.

The abdomen, or remaining section of the body, presents no external appendages for present consideration, so that we will turn for a moment or two to the internal structure of the fly, merely to mention the principal features. Directly under the dorsal surface or back of the insect is attached the dorsal vessel, or heart, a tubular vessel, running the full length of the abdomen and being constricted as it enters the thorax. This tube is situated in a cavity in which the blood collects on completing the circulation of the body, and is furnished with valvular orifices, which permit of the returned blood entering the , but which permit none to escape therefrom. The heart is also constricted at several points, and divided into a series of chambers, separated by valves, through which the blood is continually forced forward from one chamber to another, and finally distributed to the extremities of the body, from which it returns through irregular channels (there being no special vessels for its conveyance), to the dorsal cavity.

Below the heart and occupying the median line of the body is the alimentary canal which may be divided into four parts:—the gullet, the crop, the stomach, and the intestine; each having a special structure and appendages, which it is not possible to satisfactorily describe here.

Under this, along the floor of the body is located the nervous column, which, however, on entering the head splits into two branches which embrace the gullet, and knit together above it, expanding into a bilobed ganglion, or *brain*, from which nerves are distributed to the different organs of the head. In the thorax is situated another large ganglion, supplying the appendages of that segment, while in the abdomen smaller ganglia are found from which ramifications extend in every direction.

The respiratory system is also a complicated one, and differs more in its arrangement from the analogous organs of higher animals, than do the circulatory, nutritive and nervous systems. Along the under surface of the body are placed several pairs of minute breathing orifices, called *stigmata* or spiracles, protected from the intrusion of solid particles by an intricate network of five ramifying filaments proceeding from the circumference. Through these spiracles the air enters into lateral tracheæ or air tubes, from which it is conveyed by smaller branches which ramify to all parts, and to all organs of the body. By means of these minute air-vessels the blood is oxygenized as it forces its way between them in returning to the dorsal cavity. The fly has also two capacious air-sacs or pouches in the base of the abdomen, and according to some authors, two much smaller ones in the front of the head.

The foregoing is but a meagre outline of the structure and organs of the house-fly, of which the more closely we study its anatomy, either in the larval or perfect state, the more are we struck by the admirable adaptation of its structure to its mode of life.

A much disputed point in connection with the house-fly is whether it has the habit and ability to bite persons, as some other flies do. Perhaps the great majority of people would answer in the affirmative, and conscientiously attest that they had themselves been so bitten. From the formation of the fly's proboscis, with its feebly developed mandibles, it hardly seems probable that the skin could be punctured. Yet the authors of the little book already mentioned (Earth-worm and House-fly) after microscopic examination and description state that the lancets, representing the maxillæ and mandibles, "are employed to puncture the objects from which the fly sucks the juices," and are the weapons that annoy us. However this may be, it appears that the culprit who thus assails us, especially during showery weather and late in the season is a distinct species, although it so closely resembles *M. domestica* as to deceive all but entomologists familiar with these insects. Its name is *Stomoxys Calcitrans*, and it is distinguished by its long horny beak, which, as pointed out by De Geer, has a long and very sharp lancet sliding in a groove, while the fleshy sucking discs at the extremity of the proboscis are small and inconspicuous as compared with those of the house-fly. There is also a slight, but perceptible difference in the wings, and in the position in which they are held by the insect.

One naturally associates the house-fly with the habitations of man, but it is not confined to them, but extends its range over the whole country, and may be found almost universally distributed, and prepared to welcome the first human visitor to any locality. In the May number of "Psyche" appeared a short article by a Collector in the far West, showing that even in the secluded cañons of the Rocky Mountains the newly pitched tents would soon become disagreeably filled with flies, chiefly and unmistakably *M. domestica*. As the article gives an interesting account of the manner in which flies are sometimes destroyed by wasps, I will quote a portion of it.

"While camping in Santa Fé Cañon, N. Mexico, in August, 1880, this plague of flies seemed about to be unusually formidable. On the very first night the lower surfaces of the roofs and ridge-poles of the tents were fairly blackened by the immense multitudes of dipterous pests. The next morning it was observed, somewhat to the alarm of the women and children of the party, that large numbers of so-called yellow-jackets (*Vespa occidentalis*, Cr.) were entering the tents. For some time it was supposed that the object of the new-comers was to forage for sugar and other camp supplies. But before night it was noticed that the numbers of flies in the tents had been perceptibly reduced, and on the second morning it was discovèred that the wasps were intent on the acceptable task of removing our troublesome guests. There were generally as many as forty or fifty wasps in each tent at once, and each wasp was observed on leaving the tent to be carrying out the body of a fly, not for burial, nor as food for its captors, but for storage in the nests of the wasps, and undoubtedly as food for their young. Each captured fly, before removal from the tents, was deprived of its wings and legs, and on several mornings we were awakened from our slumbers by these severed members dropping upon our faces. The wasps were unremitting in their labors from daylight to dusk, and in four or five days the flies had ceased to be troublesome by their numbers, the wasps having gained upon them almost as rapidly as they entered the tents. Occasionally a specimen of *Vespa maculata* (Linn.) was observed co-operating with *V. occidentalis*, Cr., in the removal of the flies."

Although flies are able to live for several months, but a small percentage of them survive to die of pure old age. Dangers imperil their existence at every stage; a great proportion of the eggs, pupæ and larvæ are devoured by other insects, birds and fowls, or destroyed by floods and droughts; while such as reach maturity find spiders, birds, poisons, traps and deadly enemies on every side, to thin their ranks, so that of all the mighty armies of Summer, barely a corporal's guard survives until the Winter. Late in the autumn the stragglers are seen, dingy and draggled, feebly crawling about the walls, and all unlike the trim, active insects that danced on tireless wing in the summer sunbeams. Some even manage to survive the winter, by hybernating in crevices, and come forth on the approach of spring, looking still more worn and decrepit, to continue the race.

One enemy which attacks them in their old age must be specially mentioned, as its effects often arouse some curiosity in those who observe them. In the autumn many dead bodies of flies, still in the attitudes of life, are seen adhering to the mirrors, curtains and other articles in our rooms. On closer inspection a small cloudy spot will be seen to surround each, and the abdomen to be much distended, with broad whitish zones separating the segments.

A touch of the finger makes the body crumble into dust; the whole of its contents having been consumed by the fungus which is the cause of these appearances. This "fungus is a species of the genus Seprolegnia, formerly called Sporondonema, Empusa, or Achlya. It consists of short jointed threads, two or five millimeters long, growing from the bodies of flies usually in autumn. These threads enlarge in the outer end or last joint, which becomes filled with swarm spores, that, as soon as mature, burst their envelope, move about for a few hours, then come to rest, generally near the parent filament, and immediately begin to grow.

The reason that the fly remains standing where he dies is that, as the fungus consumes his internal organs, he becomes too enfeebled to overcome the adhesion of his feet to his last resting place, and the viscid exudation from the filaments of the pulvilli harden and cement them so firmly to the spot, that even after death "the fly sticks to the wall."

DIPTERA.—TWO-WINGED FLIES.

By Edmund Baynes-Reed, London, Ont.

It has been estimated by competent authority that the insects comprise about four-fifths of the whole animal kingdom ; it is therefore natural that the history of the lives and habits of this large portion of animated nature should be of vast interest and importance to mankind.

In the recognized scientific classification of insects those possessing in the perfect state only two wings are known as *Diptera*, from two Greek words, *dis*, two, and *pteron*, wing. And we purpose in this paper to give a brief outline of the history of some of the common members of this great family of *Diptera*—or flies, as they are more usually termed.

The same authority quoted above estimates the number of species of *Diptera* at 24,000. Prof. Packard, in his Guide to the Study of Insects, states, "There are about 2,500 species of North American flies described, and it is probable that the number of living North American species amounts to 10,000. In Europe there are also about 10,000 known species belonging to about 680 genera.

According to the distinguished Entomologist, Westwood, "The two-winged insects constitute one of the most extensive orders of the *Ptilota* (winged insects), not only in respect to numbers of *distinct species*, but also to the swarms of individuals of the *same species* ; and which from their constant attendance upon man have attracted his attention from the earliest ages. It is not, however, from their size that this has been the case—since few species exceed an inch in length—nor is it on account of their beauty, for the majority of them are of dull colours ; their forms, too, are rarely elegant, and the transformations of many are unknown. They owe their notoriety, if we may so speak, in many cases to the disgusting habits and appearances of their preparatory state—where many of them revel in filth of every description—and to the annoyances caused by the reiterated attacks of their numberless tribes in the perfect state, both directly upon ourselves, and indirectly upon our living and dead property of almost every kind "

Flies can at once be easily recognized from other insects by their having only two wings ; these are transparent. Instead of the hind wings common to other insects flies have two little projecting appendages, which have received the name of "halteres," or "balancers." These characteristic organs may be observed in the place usually occupied by the hind wings, and are kept by the insect in nearly constant vibration. There is much difference of opinion among Entomologists as to the special functions or uses of these balancers ; some thinking they are organs of hearing, others believing they are appendages to the respiratory organs, and some being of opinion that they serve simply to regulate the flight of the insect.

Flies are suctorial insects, and, quoting again from Westwood, "their mouth is formed only for imbibing fluid matter ; when, therefore, such fluid is enclosed in peculiar vessels, the internal pieces of the sucker are employed as lancets to pierce the envelope, and afford a passage to the fluid, which ascends by power of suction, produced by the fleshy lips of the insect into the mouth."

The head of a fly is very distinct, and is attached to the body by a very slender neck ; the eyes are exceedingly large, with numerous facets ; and those of the male fly in some species take up nearly the whole of the head.

The larvæ of flies are footless, fleshy grubs, of a whitish colour, and a cylindrical, worm-like shape ; according to Packard, in some of the higher families they have a distinct head ; but in the family of *Muscidæ*, to which the common house-fly belongs, they are often headless, and are then called maggots.

The metamorphosis, or change into the pupal state, is most complete in all the *Diptera*. Like that of the *Hymenoptera*, the enclosure consists of a thin, transparent covering, the parts being free and easily recognizable ; in many species, however, the insect undergoes its change within the larval or caterpillar skin, which then becomes hardened and forms a firm protecting case for the pupa.

Most *Diptera* lay eggs, but a few produce living larvæ, and are then called *Viviparous*, in contradistinction to the egg layers, which are termed *Oviparous*. Some few species also retain the larvæ in the interior of their body until they have reached the pupal state, and then discharge them in that condition—these are called *Pupiparous*.

One of the most noticeable features of this great family of insects is their very great profusion, and the large number of species they embrace. In all parts of the world, and at almost all seasons of the year, they seem to furnish an inexhaustible supply. The numerous class of insectivorous birds depend largely on them for their subsistence.

Another, and most important duty they fulfil is that of acting as part of nature's great army of scavengers, and removing the innumerable quantities of decaying animal and vegetable matter that are to be found on every hand. Indeed were it not for the great assistance thus rendered by hosts of insects, acting in many cases invisibly to us, it is doubtful if human life could be sustained with any degree of health or comfort.

In this great work, assigned by a beneficent Creator to the insect world, the *Diptera* or flies play a most important part; their enormous fecundity and their marvellous rapidity of generation adapting them specially for this work.

On the other hand there is no doubt that much annoyance and irritation are caused both to man and beast by the attacks of flies. With the sonorous boom of the mosquito sounding in our sleepless ears, it is difficult to philosophise calmly on the operations of this blood-thirsty insect, and to believe that there may be even a remote possibility that the attacks of this persistent and persevering fly may be conducive to our health.

To what a world, too, of untold misery is that unhappy animal subjected in the season of "fly-time," who, like Burns' "Maggie" of poetic fame, possesses "scarce a stump" to defend itself against the persecution of its irritating tormentors.

There have been trying occasions, we strongly suspect, when some of us would have been only too glad to have been able to have afforded proof to demonstration that Lord Monboddo's celebrated caudal theory was founded on fact, and that our personal comfort, as well as our landed possessions, would have been greatly enhanced by an actual and veritable enjoyment of an "estate in tail."

According to the late Prof. H. Loew, all *Diptera* have been for many years past divided into two large sections—*Nemocera* and *Brachycera*.

The first section of *Nemocera*, or thread-horned *Diptera*, have antennæ with more than six joints, and the palpi with either four or five joints. The second section of *Brachycera*, or short-jointed *Diptera*, have not more than three distinct joints of the antennæ, and the palpi have not more than two joints, and often only one.

This section embraces by far the largest number of species.

SECTION I.—NEMOCERÆ.

In this are comprised those comprehensive families known popularly as Gnats or Mosquitoes, and Daddy-long-legs, or the *Culicidæ* and *Tipulidæ*, to use scientific names.

Our well known acquaintance, the Mosquito—known unfortunately to most of us by painful experience—will stand as a representative of a very large and interesting family who are found in every part of the world—both in artic and tropical regions as well as in more moderate climes. Loew's catalogue of *N. A. species* comprises a list of 32. Figure 17 represents a female Mosquito, *Culex pipiens* Linn; the males are harmless, leaving all the biting to their more irritating wives.

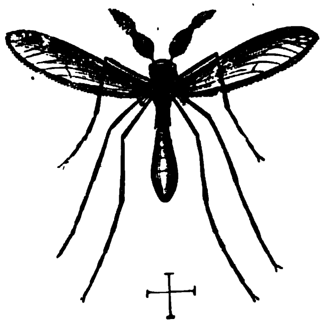

Fig. 17.

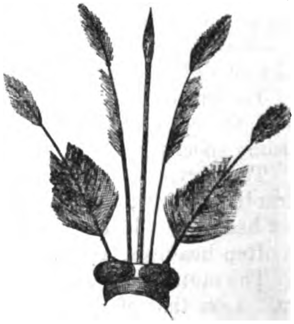

Fig. 18.

Fig. 18 shows the mouth parts of the female, and the formidable lancet she employs on her work. The eggs are laid in boat-like masses on the water and the larvæ are altogether aquatic—feeding generally on decaying vegetable matter at the bottom of the water. In this state they may be considered as essentially beneficial, checking by their operations the malaria arising from stagnant water.

The *Tipulidæ*, or crane flies, are well known to all under the familiar name of Daddy-long-legs. These, of course, are only the typical members of this large family, and are found in great numbers in wet meadow lands; the larvæ feed on the roots of grass, and very often cause a great deal of damage.

The flies have a slender cylindrical abdomen, and long slender legs, which enable them to pass easily over the higher blades of grass; the eggs are deposited by the female in the ground, and the larvæ live and undergo their transformations there.

In this section we also find a large family of insects of very small size, some of which in their earlier state reside in gall-like excrescences which they produce upon various plants; some "only produce a folding of the leaf, swelling of a leaf-rib, or arrest the growth of a bud or stalk."

These insects are known as *Cecidomyides*, or midges. Those well-known pests, the Hessian fly and the wheat midge have been well described in former reports by the Rev. C. J. S. Bethune, and their life history has been carefully related, we will therefore only refresh our readers' memories by reproducing their likeness.

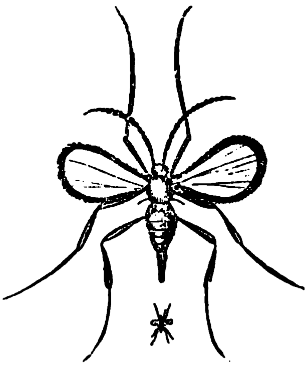

Fig. 19. Wings open.

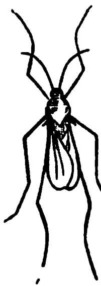

Fig. 20, Wings folded.

Fig. 19 represents a highly magnified specimen, with the wings expanded, of *Cecidomyia tritici*, Kirby, the wheat midge.

Fig. 20 shows the same insect with the wings closed.

The eggs are laid (Fig. 21) in the blossom of the wheat; and produce in about a week the larvæ, of which Fig. 22 is a highly magnified representation.

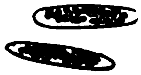

Fig. 21. Eggs.

Fig. 23 shows a wheat kernel affected by the midge. The wheat midge has transparent wings, while those of the Hessian fly, (Fig. 24), *Cecidomyia destructor*, Say., are dusky, as will be seen by reference to Fig. 24. The wheat midge attacks the ear, while the Hessian fly attacks the stalk.

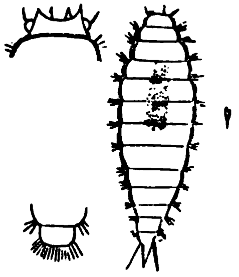

Fig. 22. Larvæ.

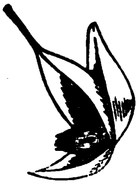

Fig. 23. Wheat leaf.

Clover Midges.

Fig. 25 is another midge known as *Cecidomyia trifolii*, Low, or the clover-leaf midge; the larva attacks the white clover, living within the folded leaves. According to Prof. Comstock "such leaves on being opened were found to contain from one to twenty whitish, or pale orange maggots, resembling much the larvæ of the clover seed midge, but being somewhat smaller. The younger maggots were nearly white, while the older ones were of a decided orange hue."

The clover seed midge, *Cecidomyia leguminicola*, Lint. as well as the clover leaf midge, were described by Mr. Wm. Saunders in last year's report.

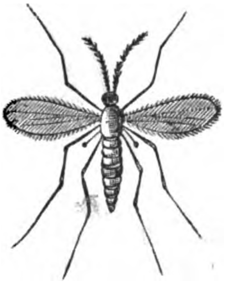

Fig. 24. Hessian Fly.

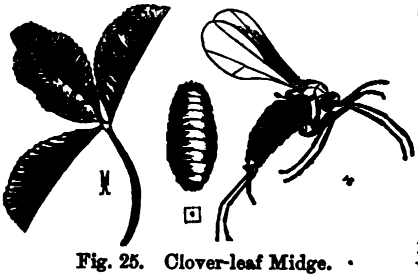

Fig. 25. Clover-leaf Midge.

Fig. 26 shows the larva highly magnified—the hair line on the side showing the natural size.

Fig. 27 represents the female fly, with her four-pointed ovipositor extended. At *b* we have the head highly magnified, and *c* and *d* show the antennæ, and the ovipositor enlarged.

Fig. 28 is the male also enlarged; *b*, the head, *c*, the peculiar clasping organs, and *d* the pedunculated joints of the antennæ, which differ from those of the female.

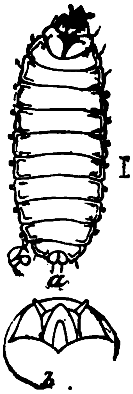

Fig. 26. Larvæ.

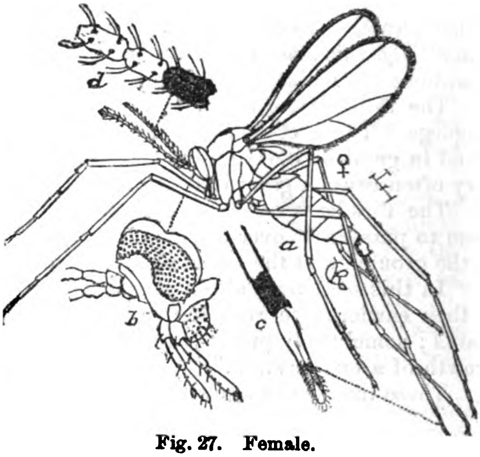

Fig. 27. Female.

GRAPE-VINE GALLS.

We will now refer to these *Cecidomyides* who produce gall-like excrescences on the plants they attack, and as specimens of their destructive work—we refer to the grape-vine galls. The flies that cause these are not yet described, but they are very similar to that shown in Fig. 29, which is a willow gall, known as *Cecidomyia Strobiloides*, O. Sacken.

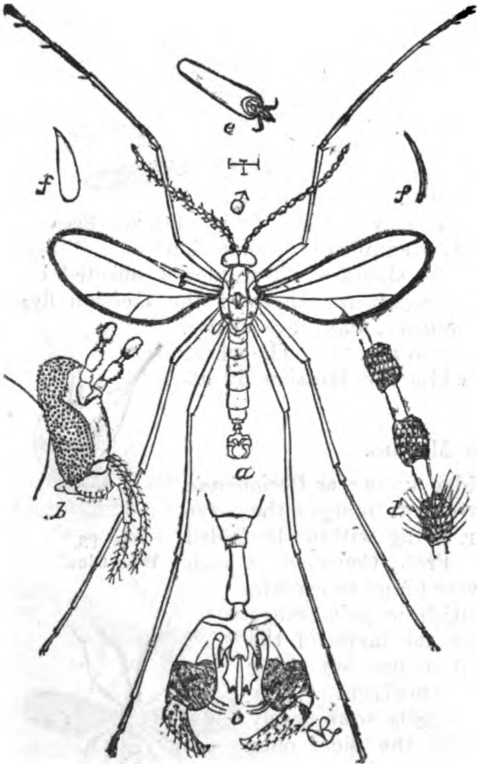

Fig. 28. Male.

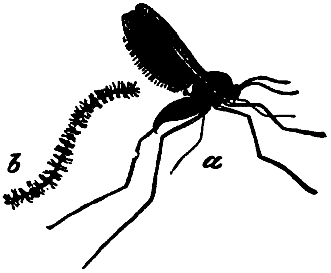

Fig. 29. Gall Fly.

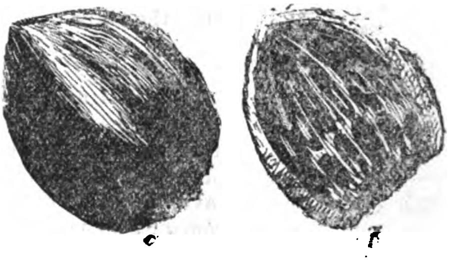

Fig. 30. Vitis Pomum.

Fig. 30 is the form known as the grape-vine apple gall, *Vitis-pomum*, Walsh and Riley. This gall is divided into numerous cells, each containing a larva.

Fig. 31 is the grape-vine filbert gall, *Vitis-coryloides*, Walsh and Riley.

Fig. 32 shows the grape leaf trumpet gall, *Vitis-viticola*, Osten Sacken. The colours of these galls are bright crimson; they are generally found on the upper side of the leaf—the galls are hollow, and contain a pale orange larva.

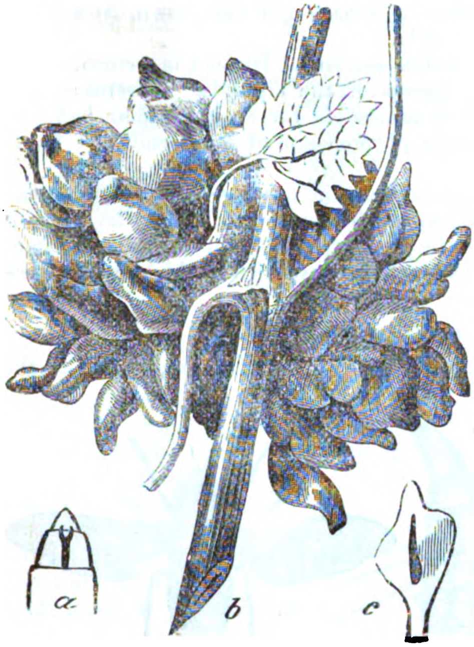

Fig. 31. Vitis-coryloides.

Fig. 33 is the grape-vine tomato gall, *Vitis-tomatos*, Osten Sacken. This gall is made by a little fly, named *Lasioptera Vibis*, which, as well as the gall, were both described by Baron Osten Sacken.

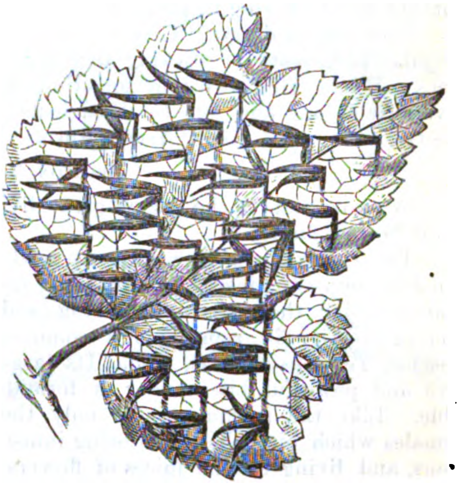

Fig. 32. Vitis-viticola.

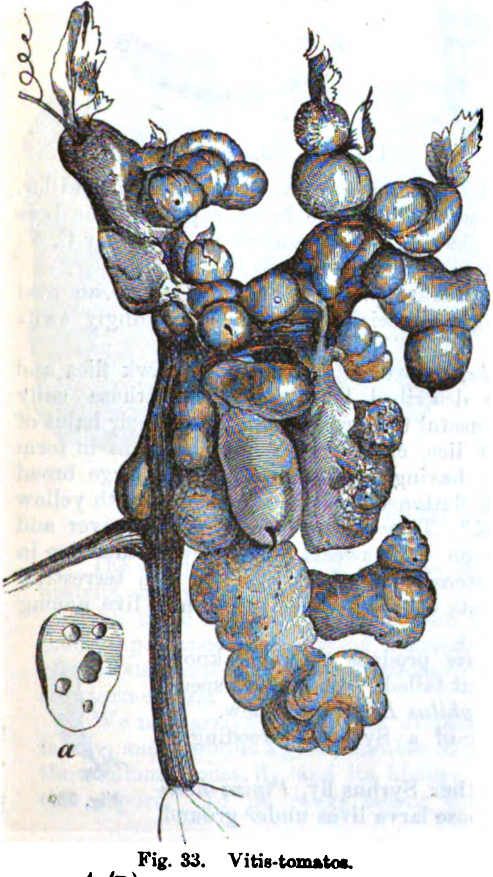

Fig. 33. Vitis-tomatos.

Another species of midge is shown at Fig. 34, which represents *Diplosis resinicola*, Osten Sacken, the resin-inhabiting Diplosis. The larvæ are found feeding in companies of thirty and forty, in the pitch exuding from the pine tree. These are pale orange, becoming brighter just before pupating. "When about to give out the adult the pupa works its way to the surface of the resin, and protrudes half its body, so that there is no danger of the midge becoming fastened in the sticky gum. Dried lumps of resin, fairly bristling with protruding pupa skins, are a common sight on trees affected by these insects."

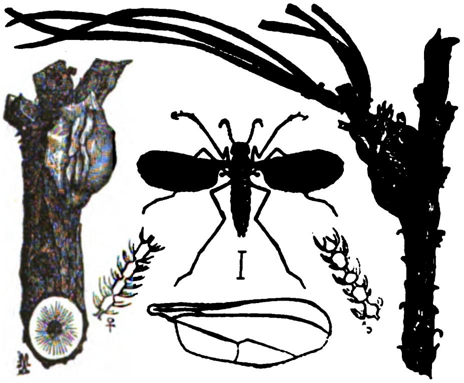

Fig. 34. Diplosis.

This midge has been observed in Florida, and at Ithaca and Tarrytown, New York State, and it is quite possible it may occur in Canada.

The history of another family belonging to this section of Diptera is a curious one. The family is called *Sciara*, and belongs to the genus of the Tipulidæ. Several species are known to occur in Canada. The larvæ are noticeable for their peculiar habit of congregating together and exhibiting the strange phenomenon of an assembly of larvæ without feet marching in procession.

Prof. Packard says "They are more gregarious than the other genera, and have the singular propensity of sticking together in dense patches, generally under the bark of trees. When full grown they sometimes march in procession in a dense mass, sometimes several feet long and two to three inches broad and half an inch in thickness, whence the Germans called them 'Army Worms.'"

SECTION 2.—BRACHYCERA.

We now come to the second great division or classification of Diptera, known as the short-horned flies.

The *Tabanidæ*, or Horse Flies, a well-known group—the insects of which are remarkable for their strength, daring and courage. Fig. 35 represents a common species, *Tabanus atratus*, Fab. Its large size and powerful bite render it formidable. Like the mosquito it is only the females which bite, the males being innocuous, and living on the juices of flowers. In its larval state, according to the late Mr. Walsh, the talented entomologist, it is useful to man, as it feeds on snails and the larvæ of root-eating insects.

The *Asilidæ*, or Robber Flies, are stout, strong insects, with long bodies. They are very rapacious, seizing and flying off with the insects they capture.

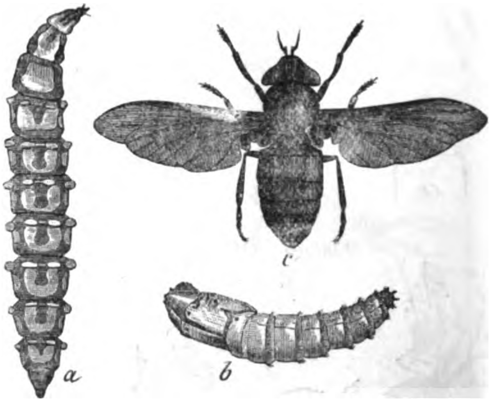

Fig. 35. Tabanus Atratus.

Fig. 36 shows one of these robbers, named *Trupanea apivora*, Fitch, or the Bee-killer. They are very destructive to the hives, capturing the bees on the wing, one having been observed by Professor C. V. Riley of Washington, to kill 141 bees in one day,

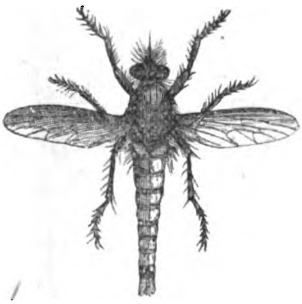

Fig. 36. Trupanea Apivora.

The *Bombilidæ* are pretty, hairy flies, with an oval body and a long proboscis. They are exceedingly swift fliers.

The *Syrphidæ*, known as the hoverers, hawk flies and drove flies, are described by Packard as "those gaily coloured flies so useful to agriculturists, from their habit of feeding on plant lice, closely resemble the wasps in form and colouration, having hemispherical heads, large broad eyes, and rather flattened bodies, ornamented with yellow bands and spots." They hover in the hot sun over and above the flowers, resting upon them to feed on their sweets. The larvæ either live in the water, where the body ends in a long extensile breathing tube; or are terrestrial living in decaying wood, or parasitically in nests of bees, or, as in Syrhus, live among plant lice.

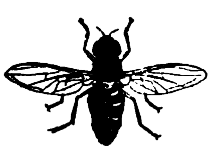

Fig. 37. Syrhus.

The species of *Eristalis* produce the well known aquatic larvæ known as "rat-tailed." A kindred species is shown at Fig. 37, *Heliophilus Latifrons*, Loew.

Fig. 38 shows the larvæ of a Syrhus fly feeding on aphis.

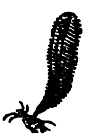

Fig. 38.

Fig. 39 represents another Syrhus fly, *Pipiza Radicans*, Walsh and Riley, whose larva lives under ground, and feeds both on the apple-root louse, *Eriosoma Pyri*, and the grape-root louse *Phylloxera Radicola.*

Tha *Ostridæ*, Breeze or Bot flies. The more common of these have already been described by the writer in a former report.

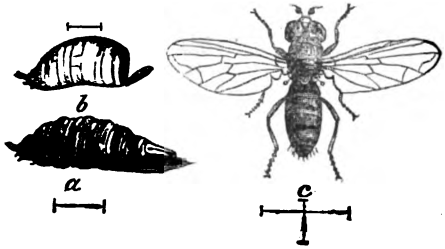

Fig. 39. Syrphus Fly.

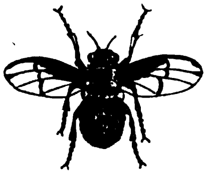

Fig. 40.
Horse-breeze Fly.

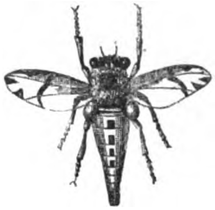

Fig. 41. Female.

The Horse breeze fly, *Œstrus Equi*, Fab. Fig. 40, male; Fig. 41, female.

The eggs are laid on the hairs of the animal (See. Fig. 42), and being licked off by the tongue, are thus conveyed into the stomach of the horse, and attaching themselves to the sides of the stomach (see Fig. 43), pass through this stage of their existence. Another fly, *Œstrus bovis*, Lat., the ox-bot fly is shown at Fig. 44, while at Fig. 45 is shown the fly just emerging from its cocoon, and a view is also given highly magnified, of the ovipositor, or instrument, by which the female deposits her egg

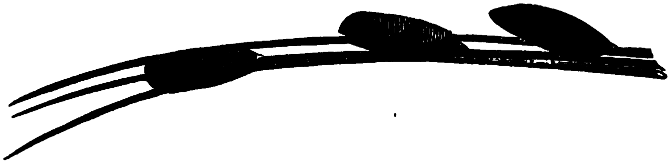

Fig. 42. Eggs of Horse-breeze Fly.

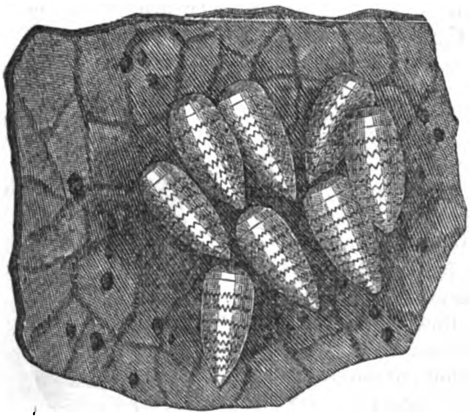

Fig. 43. Larvæ of Horse-breeze Fly.

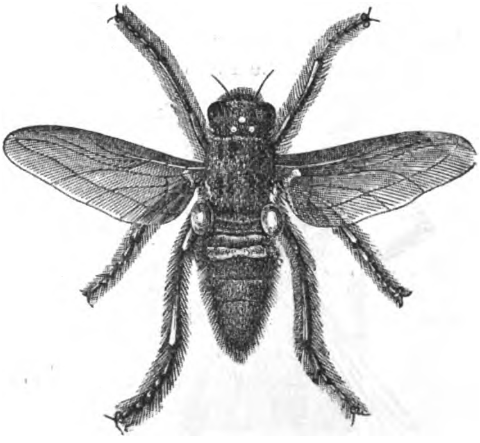

Fig. 44. Ox-bot Fly.

The sheep bot fly, *Œstrus Ovis*, Linn. is shown at Fig. 46. This fly attacks the nostrils, depositing her eggs there.

All these bot and breeze flies are greatly dreaded by the animals they attack, and their appearance causes great commotion amongst them, and very often produces a regular stampede—the animals endeavouring by their terrified flight to escape their insect tormentors.

We now arrive at our last division of this section, the *Muscidæ.* This is a large family, and contains a great number of species. The typical member is *Musca domestica*, the common house fly, and its history will be found more in detail in another part of this report. To its ranks belong the celebrated "Tsetze Fly," *Glossina Morsitans*,

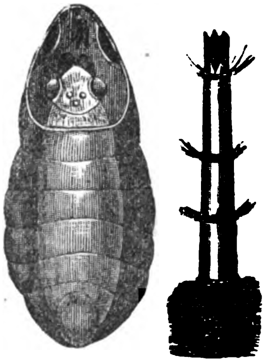

Fig. 45. Ox bot Fly Larva.

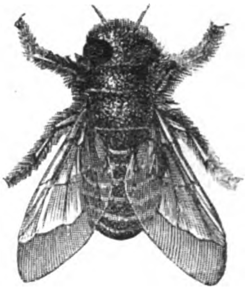

Fig. 46. Sheep bot Fly.

Westwood. This little fly, not bigger than the common house fly, is the great obstacle to the exploration of Central Africa. "It is not dangerous to man, to any wild animals, nor to the pig, the mule, the ass or the goat. But it stings mortally the ox, the horse, the sheep, and the dog, and renders the countries of Central Africa uninhabitable for these valuable animals."

The genus Tachina, of which Fig. 47 represents a species, is parasitic in caterpillars.

Tachina doryphoræ, Riley, feeds on the larvæ of the potato beetle.

The Red-tailed Tachina Fly, *Nemoraea leucaniæ*, Kirkp., Fig. 48, is parasitic on the army worm moth, *Leucania unipuncta*, Haworth. The fly deposits her eggs upon the fore part of the body of the worm. Prof. Comstock says "That as many as eighteen eggs are laid on a single worm, but the usual number is about five. These eggs are so ingeniously placed that the worm can by no possibility reach them with its jaws, or get rid of them in any other way. Mr. Howard says that he has searched for hours in a field infested with army worms without finding a single full-grown worm that did not carry one or more of these eggs upon its back." In Fig. 32, just underneath the fly is shewn the forepart of an army worm exhibiting the placing of the parasitic eggs.

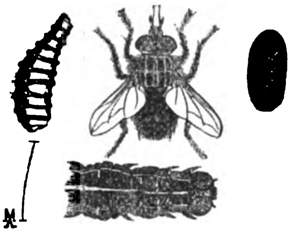

Fig. 48.

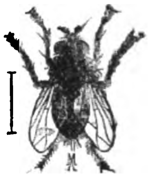

Fig. 47.

Sarcophaga, the Flesh Fly, is one of the viviparous species alluded to before.

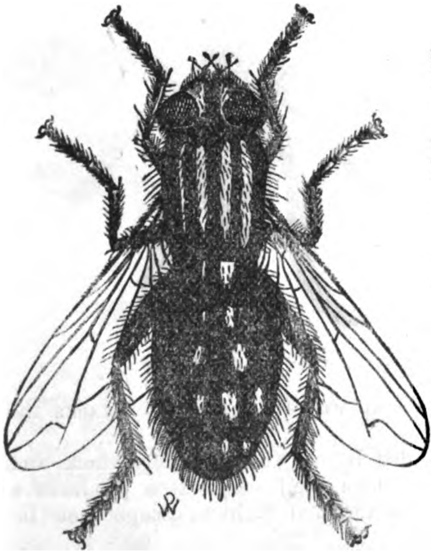

Fig. 49. Flesh Fly.

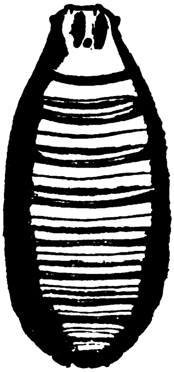

Fig. 50. Larva of Flesh fly.

Fig. 49 is an enlarged representation of *Sarcophaga carnaria*, Linn. The flesh fly and Fig. 50 shows the maggot.

The female is exceedingly prolific. The entomologist, DeGeer, vouching for the development of 20,000 larvæ in one female.

These flies sometimes deposit their larvæ on living animals, and thus become parasites.

Prof. Comstock says that "specimens of a flesh fly were reared from pupa of the Cotton worm, *Aletia Argillacea*, Hubner. These proved to be specimens of *Sarcophaga Sarraceniæ*, Riley, a probable American variety of that wide-spread scavenger, S. Carnaria, a species common to Europe, America, and Australia, certainly and probably elsewhere to be found. *Sarraceniæ* was first described by Prof. Riley as feeding upon the dead insects to be found in the leaves of *Sarracenia*, the pitcher plant. Fig. 51 represents the insect in all its stages.

The *Anthomyiæ* are to be found about flowers, and their larvæ live on decaying vegetable matter, and are all parasitic. Fig. 52 represents *Anthomyia Radicum*, Linn., var. *Coleopteri*, the Anthomyid egg parasite which was found by Prof. Riley to be parasitic on the eggs of the Rocky Mountain locust. In its parasitic capacity it has been most useful.

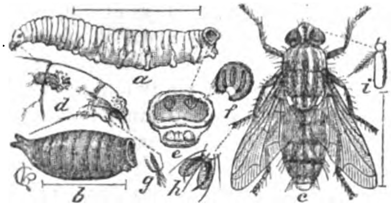

Fig. 51

Another species, the onion fly *Anthomyia Ceparum*, Bouche, Fig. 53, attacks the root of the onion. The figure shews the onion bulb with the pupa in the centre.

The larvæ of another fly, *Anthomyidæ Zeæ*, of Riley, attacks seed corn, and the radish is also infested by *Anthomyiæ Raphani*, Harris.

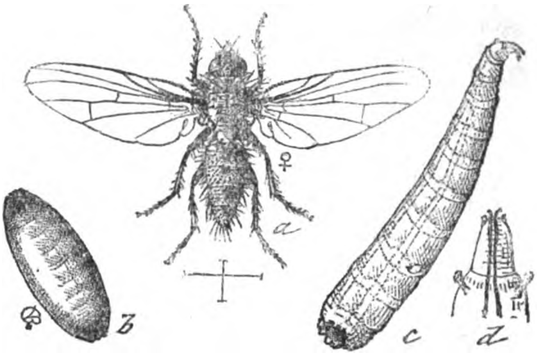

Fig. 52.

Fig. 54 represents another onion fly, *Ortalis Flexa*, of Wiedmann ; the maggot feeds on the root ; other of the same species feed on the leaves, and afterwards the fruit, of the cherry, olive, and orange.

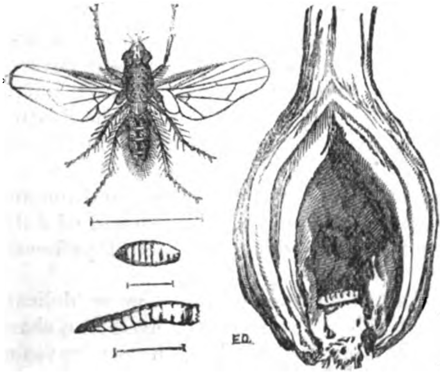

Fig. 53. Onion Fly.

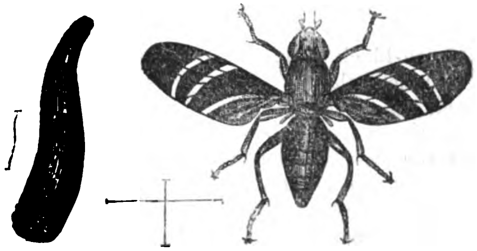

Fig. 54.

The remaining members of this section of the flies are those which are known as *Pupiparous*, and consist of she *Hippoboscidæ*, the forest flies and sheep ticks.

This closes our list, brief as it has necessarily been, of this great group of insects.

CHRYSOMELIDÆ—LEAF-EATERS.

By W. Hague Harrington, Ottawa.

The numerous species which are comprised in this extensive family of Coleoptera, are universally phytophagous, or plant-feeding beetles, and many of them are well known as destructive insects. The family name is derived from two Greek words signifying "Golden Apples," and has been applied to this group of beetles because so large a proportion of the species have rounded forms and bright colours.

Although the family embraces several thousand known species, none have yet been discovered which exceed an inch in length, and few, if any, attain that size, while the vast majority of them are small, and often very minute. It is not from their size that they are to be feared, but from the very rapid rate at which they increase in number, and enlarge the area of their depredations.

In shape they are oval or oblong, with numerous short and robust species. The eyes are prominent, and the antennæ comparatively short. The larvæ of the larger species are found feeding upon leaves, and are stout, cylindrical, fleshy grubs, with thoracic legs. They are frequently highly coloured, but the majority are not pleasing objects, and many species cover themselves with a coat of the excreted fragments of devoured leaves, which gives them a filthy appearance. The larvæ of many small species are little flattened worms mining in the leaves, that is they feed upon the inner substance of the leaf, leaving the upper and lower surfaces untouched, and making disfiguring blotches, such as are also caused by larvæ belonging to other orders.

The beetles are frequently very handsome; resplendent with gay colours and bright metalic lustres, or ornamented with quaint and striking markings. About five hundred species are recorded from the United States and Canada, and in both countries considerable damage has been inflicted by different species.

Descriptions of several species and accounts of their operations have already been given in previous Reports, but as they are scattered through the different numbers, and perhaps inaccessible to some who may receive this, a brief review of them (as they are reached) may not be superfluous.

The genus Donacia, with which the family commences, approaches in some respects to the Cerambycidæ, or "long-horned" beetles, and serves as a partial link between that family and the Chrysomelidæ. The beetles of this genus differ from those of most other genera in having longer and more cylindrical bodies and longer antennæ. The larvæ are said to live in the stems of water-plants, and to make a leathery cocoon in the earth before transforming. I have often found empty cocoons of such nature attached to roots of aquatic plants.

Donacia proxima, Kirby, probably our largest species is a fine beetle of a deep bluish-black colour above, while the under surface is silvery-white, being densely covered with short hairs. The thighs of the hinder legs (as in many of the species) are swollen, and bear a short tooth. The beetles are found on hot summer days upon the floating leaves of the water-lilies, where they mate and sport in the bright sunshine, which gives to them an added lustre.

Donacia subtilis, Kunze, our most common species is very abundant in June and July upon rushes and sedges. *D. æqualis*, Say, may be found towards the end of July, feeding upon the leaves of Sagittariæ. *D. pubescens*, Lec., owing to a coat of yellowish hair, lacks the lustre of the previous species.

Hæmonia nigricornis, Kirby (*Melsheimeri*, Lac.), is a smaller and more delicate beetle, of a yellowish colour, and having the tip of the wing-cover prolonged in a sharp spine. It occurs somewhat abundantly in the latter part of June upon the leaves of *Potomageton natans*, where it is, from its colour, very inconspicuous. It seems equally at home in the water as in the air. I have seen, and captured, specimens paired beneath the surface of the water, while other individuals, also completely submerged, were feeding upon the epidermis of the leaves. It walks easily upon the surface from plant to plant, and has the habit of running a little distance upon the water and taking flight therefrom, instead of directly from the leaf upon which it has been.

Leaving the aquatic species, we come to a small, slender beetle, very common upon flowers in spring and early summer. This insect, *Orsodachna Childreni*, Kirby, varies remarkably in coloration, and several of its varieties were formerly described and known as separate species. It ranges in colour from a tawny-yellow to black, and one well-marked variety has the head and elytra black, while the thorax is red.

Syneta tripla, Say, is a pretty reddish or yellowish beetle, found in May or June feeding upon the leaves of beech, elm, etc.

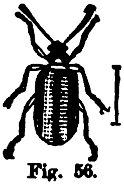
Fig. 56.

Lema trilineata, Oliv., is about as long as the last species, but is broader and more stoutly built. It is an orange-red beetle, with black eyes, feet and antennæ. There are also two black spots upon the thorax, and the elytra bear three broad, black stripes, which give to the beetle its specific name. (See Fig. 56.) It is found abundantly upon potato plants throughout Canada, and is popularly known as the "Three-lined potato beetle." The eggs are deposited upon the under side of the leaf (see Fig. 57*d*), upon which the dirty-yellowish larvæ, covered with mantles of their own excrements, may be found feeding in mid-summer. (See Fig. 57*a.*) They attain their full size in about two weeks, when they descend to the ground and transform in earthen cells, formed of small grains cemented together by a gummy exudation from the mouth. In about a fortnight the rather handsome beetles emerge, and may be found in about potato patches during August and a portion of September.

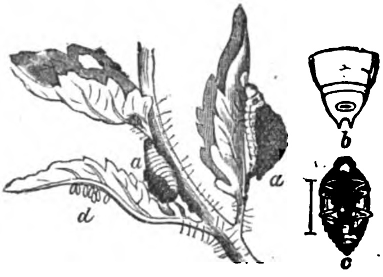

Fig. 57.

Crioceris asparagi, Linn., the European asparagus beetle, is a closely allied species, which has followed to America the celebrated food-plant from which it derives its name. It was figured in the Reports for 1880 and 1881, but as no description of the beetle was then given, I will insert it here as given by Miss Ormerod, in whose valuable "Manual of Injurious Insects" it is the first species described. Fig. 58 shows the beetle, larva and egg, all much magnified; the natural length of the egg and beetle is shown by the lines at the foot of the figure. The eggs are attached by one end along the young shoots, as figured. The grubs are of a dirty olive or slate colour; are fully fed in a fortnight, when they descend into the ground, transform in parchment-like cocoons, and in two or three weeks emerge as perfect beetles. These are about a quarter of an inch long, blue-black or greenish, the body behind the head red, with two black spots, the wing cases are ochreous-yellow, with a line down the centre of the back, a branch from each side, and a spot at base and tip of each wing-case. The beetles on emerging from the ground lay their eggs, and the insect is found in all stages, from about the middle of June to the end of September.

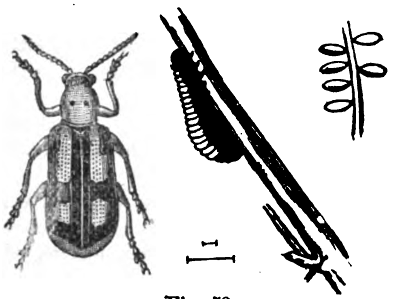
Fig. 58.

This beetle appeared in eastern New York more than twenty years ago, and threatened at one time to destroy the extensive asparagus plantations on Long Island. Its depredations were soon checked, however, and its spread prevented. Our Report for 1880 gave methods of dealing with the larvæ, but did not mention the application of freshly slacked lime, which is stated by Mr. A. S. Fuller (Am. Ent., page 4) to be the most practicable and effectual method. The best time to dust the plants, with the finely powdered lime, is while the dew is still on them, or after a shower. The lime almost instantly kills every larva it touches, and those that escape may be destroyed by a second application. So effectual was this process found, that about one applicafion every alternate season sufficed to keep the insect in check.

Anomœa laticlavia, Forst., is a stout beetle, slightly more than one-quarter of an inch long and half as wide. It may be considered as belonging to the aristocracy of the Chrysomelidæ, for its specific name of *laticlavia* means, in Latin, having a broad purple stripe—a mark of distinction borne by senators, military tribunes, and the sons of distinguished families. The abdomen, legs, eyes and antennæ are blackish, the head, thorax and elytra are ochraceous, while a broad purplish black stripe runs down the back, and a narrow one along the margins of the elytra. Found upon willows, cherry, etc., in June and July.

Coscinoptera dominicana, Fab., the Dominican case-bearer, is a cylindrical beetle, nearly one-fourth of an inch long, and is well represented in all its stages in Fig. 59 (after Riley). In the figure, *a*, shows the larva extracted from its case; *b*, the same dragging its case, which is composed of chewed fragments of leaves; *c*, beetle enlarged to show

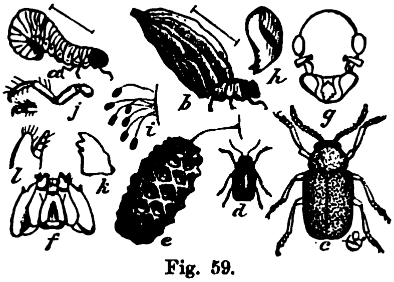

Fig. 59.

punctures; *d*, same natural size; *e*, the egg enlarged; *f*, head of larva, underside; *g*, head of male beetle; *h*, jaw of same; *i*, eggs natural size, showing the curious manner in which they are attached to leaves; *j*, leg of larva; *k*, jaw of same; *l*, maxillæ of same.

The genus Chlamys contains beetles differing greatly in general appearance from those previously described. They are short and thick set, resembling when at rest dried buds or bits of bark on account of their curiously knobbed and wrinkled elytra and thorax. The larva (Fig 60) like that of the preceding species constructs for itself a sac which it bears about with it while feeding on the leaves, like a snail carries its shell. The larva (figure *a*) is a small stout grub, having the posterior end recurved in the sac, from which the head and legs protrude. The case is composed of small pellets of vegetable matter.

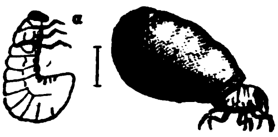

Fig. 60.

Chlamys plicata, Fab., "is a little oblong, cubical, roughly shagreened, metallic greenish beetle, found in abundance upon leaves southward." A variety known as *C. polycocca*, Lac., is found here in June, and is of a dull brown or coppery colour.

Monachus saponatus, Fab., is an almost globular steel-blue beetle, one-tenth of an inch long, taken upon alders and plants growing in low woods and meadows.

The genus Cryptocephalus contains a great number of small cylindrical beetles, having the head withdrawn in the thorax, whence the generic name signifying "buried head." The larvæ, like those of Coscinoptera and Chlamys, are case-bearers.

C. maculatus, Say, is a bluish-black beetle, one fifth of an inch long, with an orange-red spot on the tip and shoulder of each wing-cover. They are abundant throughout the summer on pines, and less frequent on other trees.

C. luteipennis Mels., is a smaller species, having orange wing-covers, which is very abundant upon willows.

Pachybrachus is another extensive genus of small cylindrical beetles, having the head less retracted within the thorax. *P. tridens*, Mels., prettily mottled with yellow and brown; appears in numbers upon willows.

Another beetle frequently found upon willows is *Adoxus vitis*, Linn., a black insect of robust form, and about one-fourth of an inch long; the elytra are a dark reddish-brown. The word *vitis* being the Latin for vine, this beetle may, perhaps, be found upon grape-vines, although I do not remember to have seen any statement to that effect.

The next member, under present classification, of the Chrysomelidæ is *Fidia viticida*, Walsh, the Grape-vine Fidia (Fig. 61), which also derives its name from the same source. It is slightly longer than the preceding species, but of very similar shape; its colour is chestnut-brown, and it is covered with short whitish hairs, giving to it a hoary appearance. It is very injurious to grape-vine leaves in the Western States, riddling them with large holes, and when numerous reducing them to mere shreds.

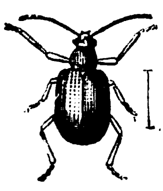

Fig. 61.

Glyptoscelis pubescens, Fab. (*hirtus*, Oliv.), is a coppery, and, as its name denotes, pubescent or hairy beetle, the hairs not being very close. It is one third of an inch long, and appears upon the leaves of pines in May and June.

Upon Dog's-bane and Indian hemp, about the end of July, may be found numbers of a very beautiful beetle named *Chrysochus auratus*, Fab., both names signifying golden. Its colour is a brilliant green, when seen in a dull light, but when crawling upon the plants under a bright sun the colours are irridescent, and they appear like rubies and emeralds upon the leaves.

Paria aterrima, Oliv., common here upon different plants, is said by Prof. J. A. Cook (Michigan) to be very destructive to strawberries, for though small they are so numerous and voracious as often to defoliate the plants. The larvæ are white, with yellowish heads and brown jaws, are about one-fifth of an inch long, and transform in a small, spherical, earthern cocoon. The beetle is about one-eighth of an inch long, and varies in colour, some being all black, while others—perhaps the greater number—have the head, antennæ, legs and wing-covers yellowish, the latter having each two black spots. They may be destroyed by applications of Paris green or London purple, but these poisons should not be used after the berries have formed.

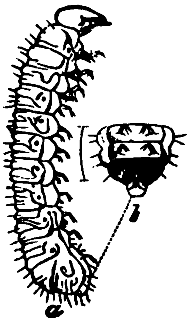

Fig. 62.

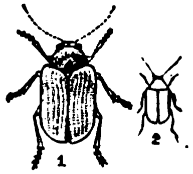

Fig. 63.

One of our allied beetles, *Colaspis flavida*, Say., feeds also in the larval state upon the rootlets of the strawberry. Fig. 62 represents the larva, Fig. 63 the mature insect.

We now come to the extensive genus Chrysomela (golden apples), which contains our largest beetles of this family. The most generally known, as well as the most generally hated of these is *C. decem-lineata*, Say, the ten-lined chrysomela, or as it is more commonly called the Colorado potato beetle. This insect has already been described and frequently mentioned in our Reports, and its appearance and habits are so well known to all agriculturists that only a very brief account of it must be given here. Over sixty years ago, in 1819 or 1820, it was discovered by Say along the Upper Missouri, near the base of the Rocky Mountains, where it fed upon Solanum rostratum, a wild plant belonging to the same genus as the cultivated potato (Solanum tuberosum). Its discoverer had probably no idea that at some future day it would so far extend its range and prove so noxious an insect, but as the country became settled it was found transferring itself to the potato fields, where it obtained a more abundant and constant supply of food, and where it increased in numbers proportionately. By 1861 the beetles had become so numerous in Kansas that over two bushels of them were gathered in one garden. During the last twenty years they have rapidly extended their range eastward, and in the past summer they have been reported from Nova Scotia. While they still cause much trouble and a certain amount of loss to pototo growers, they are no longer feared as they were when their ravages were first made known. Paris green and London purple, when properly applied, have proved efficient destroyers, while planting early ripening species of potatoes, ensures their maturing before the beetles become numerous enough to do much injury to them. Gradually also insect enemies have increased in kind and number, among which may be named *Podispus spinosus*, Dallas, the (Spined Soldier-Bug, Fig. 64); *Perrillus circumcinctus*, Say (the Belted Soldier-Bug, Fig. 65); *Harpactor cinctus*, Fab. (the Many-banded Robber-bug, Fig. 66); *Lydella doryphoræ*, Riley, a two-winged fly, of which the larvæ are parasitic in the grubs of the beetle; *Lebia grandis*, Hentz (Fig. 67, where it is shown magnified, and also of the natural size); and other beetles belonging to the Carabidæ, and several species of Lady-birds (Coccinellidæ), of which the largest is *Mysia 15-punctata*, Oliv. (Fig. 68). Notwithstanding the aid thus rendered to man it will be a very long time before the beetles are so far exterminated as to be rarities. The patches of yellow eggs upon the leaves, the loathsome yellowish-red, black-spotted larvæ destroying the tops, and the beetles crawling in striped yellow and black

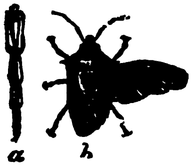

Fig. 64.

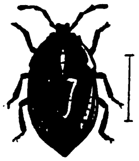

Fig. 65.

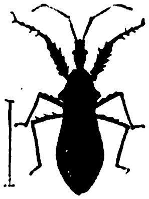

Fig. 66.

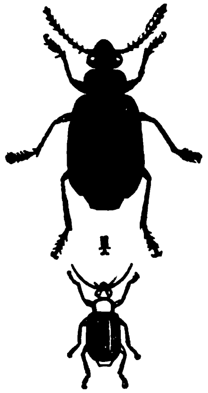

Fig. 67.

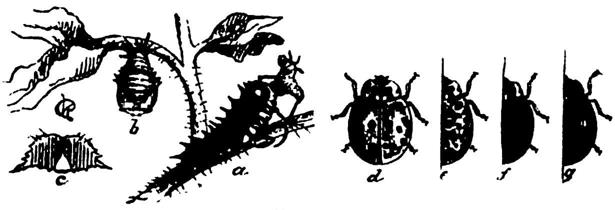

Fig. 68.

jackets about the fences and roads, or sailing with pink wings through the air, will long be familiar objects. Fig. 69 shows this insect in it several stages—*a*, the eggs; *b*, *b*, *b*, the larvæ at different periods of growth; *c*, the pupa; *d*, *d*, the beetle natural size; *e*, a wing-cover much enlarged.

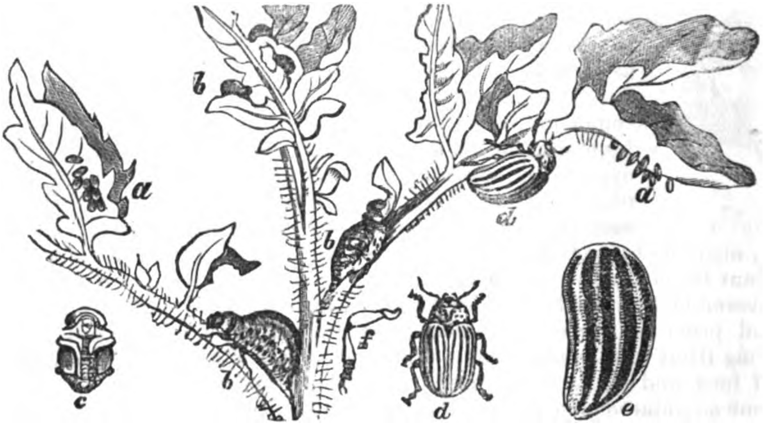

Fig. 69.

C. clivicollis, Kirby (*Labidomera trimaculata*, Fab.), is a handsome beetle, about the size of the preceding species, found upon the common milk-weed during the autumn. It is of an oval, rounded-convex shape, and of a deep bluish-green or greenish-black colour, the feet being purplish. The elytra are orange, with a broad bluish band across the back and a large bluish spot near the tip. The markings vary greatly in outline, and the band is often interrupted so as to form two irregular spots on each wing-cover.

C. multiguttata, Stal., (*Scalaris*, Lec.), is a somewhat smaller beetle, varying in size, found throughout the season on various trees, as the elm, the linden, and especially the willows and alders. Its eggs are laid on the underside of the leaves. The larvæ are short, stout grubs, about half an inch long, whitish, with a black line along the top of the rounded back, and a row of black spots on each side of the body. The beetle is greenish, with yellowish legs and antennæ; the elytra are yellowish with many green dots varying in shape, and a broad band runs down the back where they meet, and gives off three or four branches on each side, forming as it were steps, whence the name *Scalaris* from a Latin word meaning a ladder. There are said to be two broods, the first in April, May, and June, and the second in September and October. A very beautiful variety of this species (*C labyrinthica*, Lec.) is sometimes found, which differs so much in colouration as to seem a distinct species; it also appears to be slightly larger. The body of the beetle is of a deep black, with a slight bluish tinge, as are also the legs and antennæ. The elytra have a jagged, irregular border of white, and there are two rows of four white spots upon the back. The margin and spots vary, however, in different specimens, and are more or less joined together. I captured several specimens in 1878, but did not meet with it again until I took one last summer.

C. philadelphica, Linn., is a smaller bettle of very similar appearance to *C. multiguttata*, which feeds upon pine leaves in May and June.

C. elegans, Oliv., is, as its name implies, an elegant little bettle one-fourth of an inch long, which appears very early in spring, is abundant for a couple of months, and is occasionally taken late in the autumn. It is a black beetle with white or yellowish stripes upon the wing-covers. Although so common I have as yet been unable to determine upon what it feeds.

Gastrophysa polygoni, Linn., is a small bettle, one-fifth of an inch long; very abundant all summer, and remarkable for the manner in which the abdomen of the gravid female is distended with eggs. The head is blue-black, the thorax and legs are rufous, and the elytra are a brilliant and metallic blue.

Plagiodera lapponica, Linn., is more elongated and flattened than species of the genus Chrysomela. It is one-fourth of an inch long; black; the elytra, orange with black spots, and is found upon alders and willows. The larva is of a dingy yellowish-white colour, with black head and legs. Upon the sides and back are rows of small dusky tubercles; the outer-dorsal rows being more distinct and capable of emitting from their tips a milky, pungent fluid.

P. Scripta, Fab., a very closely allied species, (by some held to be but a variety of the last) has proved itself a very destructive insect in the Western States; especially in the prairie regions, where it has become a grievous pest on account of its depredations on the cottonwood. This tree is grown very extensively as a shade and ornamental tree, and for fuel, and vast groves are stated to have been utterly destroyed by repeated defoliations. The eggs are laid in clusters, of from ten to one hundred, on the young leaves in the spring and quickly develop. There are two or three broods during the summer.

Monocesta coryli, Say., (corylus being the latin for a hazel, or filbert tree,) is known in the United States as the Great Elm-leaf Beetle, and is occasionaly very destructive to the red or slippery elm. Its eggs are laid on the under side of the leaves in June, and from them issue in a few days brown, or yellowish brown larvæ, which, growing rapidly, "eat the leaves into rags." About the end of July they enter the ground and pupate.

The genus Diabrotica contains a number of species, of which *D. vittata*, Fab., the Striped Cucumber Beetle, is a well-known gardener's pest. It was well figured and described in the Report of 1878. The little lemon-yellow bettle (Fig. 70), with a black head and three black stripes on the wing-covers, makes its appearance as cucumbers, squashes and melons commence to show above ground. It feeds upon the young leaves, and at the same time deposits its eggs near the roots of the young vines. From these hatch out slender white grubs having small brownish heads, and slim, pale-brown thoracic legs. Burrowing into the stems just below the surface of the ground (the plants being thereby weakened and often destroyed), the larva reaches maturity in about a month from the deposition of the egg, and is then one-third of an inch long. Leaving the plant it pupates in a little cell in the earth, and emerges after a couple of weeks as a beetle, which feeds upon the young shoots and buds. There are two or three broods during the season, the last remaining in the ground all winter as pupæ. An effective, and not expensive, method of protecting the young plants is to cover them with wooden frames having gauze tops.

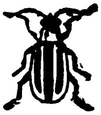
Fig. 70.

A larger but less common species is that known as *D. 12-punctata*, Oliv., or Twelve-Spotted Diabrotica, which derives its name from twelve black spots upon the elytra (Fig. 71). It is stated by Packard to be injurious to the leaves of the dahlia.

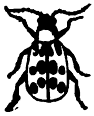
Fig. 71.

Within the past few years a beetle belonging to this genus, and closely allied to our cucumber beetle, has become noted in Illinois, Missouri and other Western States as a corn pest. The larvæ of *D. longicornis*, Say, the Long-horned Diabrotica, are very similar in size and appearance to those of our cucumber beetle, and feed on and in the roots of the young corn-plants, causing them to wither and die. The beetle is of a uniform pale greenish-yellow, without any markings. The application of lime and ashes around the young corn is proposed as a preventative.

Several species of the genera Galeruca and Galerucella are found in Canada, they are similar in form to Diabrotica, but, generally a little smaller and of a darker colour. *Galeruca rufosanguinea*, Say, is well described by its specific name which means blood-red. It is one-fifth of an inch long and is found upon various trees. Last June it was abundant on choke-cherry.

Galerucella marginella, Kirby, has been described by Packard as found in all its stages upon Myrica gale in August. The larva is shining black and the beetle closely resembles the following species, except in being darker.

G. xanthomelina, Schr., (the imported elm beetle) is said to feed upon the elm in such numbers as often to wholly defoliate the trees. In 1879, the elms of Newburg, N. Y., a town celebrated for its fine avenues of this handsome tree, were almost stripped by these beetles. The larvæ are thick, cylindrical, blackish grubs, producing greyish-yellow beetles distinguished by three black dots on the thorax, and a black stripe on the outer edge of the elytron.

G. sagittariæ, Kirby, is a dark brownish species (with the exception of a yellowish line around the margin of the wing-covers), which I have found about the middlo of September abundant upon the leaves of the water-lily, in the larval, pupal, and perfect stages. It is also given by Packard as occurring upon the willow.

We now come to a large group consisting of several genera of small—often minute—beetles having the thighs of the hind pair of legs much enlarged and very powerful, by which the beetles are enabled to jump a great distance (in proportion to their size) when disturbed. From this characteristic they are known as Halticas, or Flea-beetles.

The genus Oedionychis contains a number of species, of which *O. quercata*, Fab., is a common one. It is a dark bettle, of oval form and variable markings. Its name associates it with the white oak, and it is found upon other trees as well.

Another extensive genus is Disonycha which contains some of our handsomest Flea-beetles. *D. glabrata*, Fab., a pretty little beetle with yellow and black striped wing-covers; *D. collaris*, Fab., a bluish-black beetle with a red thorax, and *D. triangularis*, Say, closely resembling the latter, except that it bears three black dots upon the yellowish thorax, may be found in October sheltering themselves under cornices of buildings, or in crevices, etc. They may also be found early in spring under stones, loose bark, etc., where they have hibernated. *D. alternata*, Ill., a large handsome species is rare here.

Graptodera chalybea, Ill., is well known to grape growers as the Grape-vine Flea-beetle. In some seasons it is very abundant, and inflicts a considerable amount of injury. The greatest loss is caused by such beetles as have hibernated under loose bark, fallen leaves, and stones, or in crevices, outbuildings, or other refuges from cold, and which appearing early in April bore into and feed upon the bursting buds. Afterward they feed upon the young leaves, on which during May the female deposits clusters of small orange eggs. Soon hatching, the little dark-coloured larvæ (Fig. 72 *a*), proceed to riddle the leaf, and when very numerous may completely devour it; *b*, shows one enlarged, the faint line indicates the natural length. At the end of a month the larva descends from the vine and pupates in a small earthern cell (Fig. 72, *c*), from which the beetle (*d*, enlarged) emerges about three weeks later. It then feeds upon the leaves, but does, however, comparatively trifling damage. Such beetles as do not fall a prey to various enemies seek, on the approach of cold weather, a sheltered retreat in which to spend the winter. There is only one brood each summer. The best method of checking their ravages is to collect them (as proposed by Mr. L. O. Howard, Asst.-Entomologist to Department Agriculture, Washington) upon sheets drenched with coal oil.

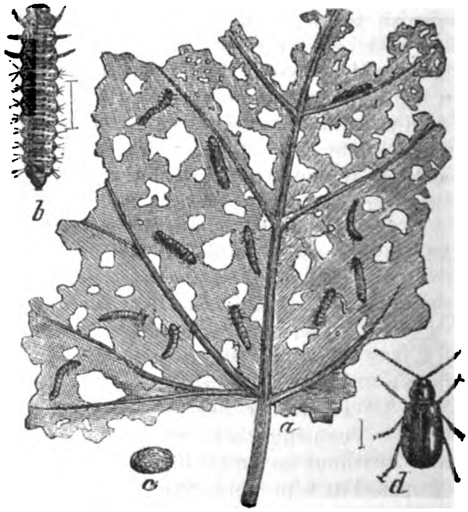

Fig. 72.

Phyllotreta vittata, Fab. (*Haltica striolata*, Ill.) the Striped Turnip-flea-beetle is one of our very commonest insects. It may be found at any time during the season, from the first mild days of spring until the end of October. During the earlier months it appears in swarms upon various plants, and upon fences, etc. The larva (Fig. 73, *a*) is a slender white grub, one-third of an inch long, feeding upon roots underground, where, in a little earthern cell, it changes to a naked white pupa (*b*). About a fortnight later it emerges as a little black beetle (also shown in Fig. 73), less than one-tenth of an inch long, but readily determined by the waved, yellowish or reddish stripe on each wing-cover, the stripe sometimes being interrupted so as to form two spots. The beetles feed upon the seed-leaves of turnips and cabbages, as well as upon other veget-

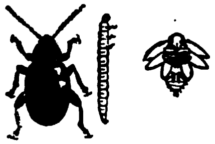

Fig. 73.

ables, and are thus very injurious; while the plants are also weakened and killed by the larvæ feeding upon the roots. In England there are several allied species very destructive to turnips, but the larvæ mine in the leaves instead of feeding upon the roots.

Systena marginalis, Ill., a slender, yellowish beetle, one-fifth of an inch long, with a narrow black line down the sides, is often very common upon elms, hickory, etc. I found them especially adundant last season late in September upon some small oaks, the leaves of which were much eaten. The beetles were at this time nearly all paired, and were much more sluggish than they were three weeks previously, when I had noticed a great number on some sweet-hickories.

Epitrix cucumeris, Harris, the Cucumber Flea-beetle, is about the size of the turnip beetle above described, and of similar habits, except that the larvæ mine the leaves of the plants. The beetles (Fig. 74) are about one line in length, are black, with yellowish antennæ and legs, and have the elytra roughly punctured. They feed upon the seed-leaves of cucumbers, thus killing the young vines, and are found throughout the summer upon turnips and various garden vegetables, eating holes in the leaves.

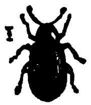
Fig. 74.

There are a great number of small species belonging to the above and allied genera, of very similar habits, and often injurious to cultivated as well as to wild plants. During the winter such specimens as are to perpetuate the race seek refuge in crannies and crevices of walls and fences, under stones or loosened bark, in tufts of moss, among fallen leaves, in hollow stems of plants, etc. There, sheltered from the wet, they withstand the severe frosts of our long winters, and come forth in the first warm days of spring to renew their depredations. In the interval between their awakening and the appearance of the cultivated vegetables upon which they feed, they subsist upon various species of wild plants. We thus see, in regard to these insects as well as to many others, the evils which may result to crops from leaving rubbish heaps and neglected corners about the fields for insects to winter in, or to obtain sustenance in the early season. Of course numbers of them hibernate in waste and wooded tracts, whence they invade the fields and gardens in spite of every care; still it will pay to keep gardens and fields free from stone and rubbish heaps, from strips of weeds and brambles along the fences, and neglected spots of any kind.

Odontota (Hispa) rosea, Web., is very different in appearance from the previously described species, not having their oval or rounded shape. The wing-covers are truncated posteriorly, instead of being rounded off, and form a parallelogram, to the anterior end of which is applied the base of the triangle formed by the tapering thorax and small head. The short stout antennæ project in the form of a V. The beetle, about one-fifth of an inch long, is of a tawny-reddish colour above, with irregular darker spots and lines upon the elytra, the legs are yellow. Each wing-cover has three raised lines, with the intervening spaces deeply punctured. The larvæ mine in the leaves of various trees, those of the apple among others, and are, when full-grown, about one-fourth of an inch long. They pupate in the leaves, and about a week afterward the beetles come forth from their mines, and may be found upon oaks, hawthorns, etc. There is a smaller and darker variety of this species, of which I took several specimens last season on elms.

Chelimorpha argus, Licht. (*Cribraria*, Fab.), is an interesting beetle, and is among the largest of our Chrysomelidæ. Some specimens appear nearly as large as potato beetles, but they are not nearly so stoutly built. They are known as tortoise beetles from the great resemblance they bear in figure to those reptiles. The sides of the thorax are flattened, and project so as to hide the head, while the ample elytra also entirely hide the body. The under surface of the body, and the legs are black, but the thorax and elytra are ochraceous-yellow, the former having six small black dots, the latter fifteen, varying in size. The beetle feeds upon various plants. Packard mentions it as "found in all its stages on the leaves of the milk-weed late in July and early in August, and in one instance it occurred in abundance on the leaves of the raspberry." It feeds here upon convolvulus very frequently. The larva is a broad and thick yellow grub, three-fourths of an inch long, and partially covered by its cast larval-skin. The pupa (attached to a leaf) is more broad and flattened; it is of a dark colour, but covered with a whitish powder. Two stout spines project from each side of the thorax, and five smaller ones from each side of the abdomen.

The family of the Chrysomelidæ terminates with the Cassidiidæ, a group of beetles deriving their name from the Latin word cassida, a helmet, and they are commonly known as Helmet beetles, from their fancied resemblance to that portion of a warrior's armour. Some of the species are very beautiful, the colours being delicate and brilliant. The wing-covers and the sides of the thorax protrude so as to entirely cover the legs and head when the beetle is at rest, but the margins are so thin as to be quite transparent.

Coptocycla (*Cassida*) *aurichalcea*, Fab., the Yellow Helmet beetle, is often found upon morning glories, and is shield shaped, and of a beautiful golden-yellow colour. The larvæ feed upon the leaves of the morning glory, and are of a broad, oval, flattened form. The tip of the abdomen is armed with two diverging spines, forming a fork, with which the larva heaps upon its back, as a protective covering, its excrement and cast larval skins.

We have now hastily reviewed this large and interesting family, as represented in Canada, and endeavoured to describe the appearance and habits of some of the more common of the species. Much, however, remains to be learnt in connection with the life-histories of many of the species. A few beetles have also been mentioned which may not have yet reached this country, but which have proved troublesome in the United States within recent years.

NOTES OF THE YEAR.

BY WM. SAUNDERS, LONDON, ONT.

The Grape Phylloxera.

Phylloxera Vastatrix.—This tiny but formidable foe to the grape vine, which has during the past few years attracted so much attention in Europe and America, has appeared in its worst form, viz.: the root-inhabiting type, in Ontario, and is doing a considerable amount of damage in our vineyards. Early this spring the writer received from Mr. A. H. Pettit, of Grimsby, samples of fibrous roots from diseased vines, which had every appearance of being affected by the Phylloxera, but the specimens were so dried up that if there had been any lice on them they could not be discovered. Request was made for fresh specimens in moist earth, but none were obtained.

On the 19th of July, in company with Mr. J. M. Denton, of London, I visited the vinery of Mr. Richard Stephens, in Westminster, about a mile from London, where we found a number of Concord vines growing in heavy clay soil, which were suffering much from some cause; the foliage had become very yellow and some of the vines appeared to be dying. On examining the roots, we could find but few living, and the fibrous roots were covered with the little knotted swellings so characteristic of Phylloxera. On digging around some vines that were less diseased, a number of the lice were discovered on the young, fresh roots, puncturing them, imbibing their juices, and causing disease and death.

On the following day, another vinery was visited, near London, where the vines were planted on sandy soil, when the same form of Phylloxera was detected on Rogers 15 and some seedling grapes, but, in this instance, the disease was much less pronounced. On examining the roots of these vines, the insects were found in the egg state, and also as larvæ of various sizes in comparative abundance. In the vinery of Mr. Stephens' the insects must have been at work for several years past, to have caused the extent of injury which we saw; but, in the other case, the invasion appeared to be a more recent one. It was gratifying to find, on Mr. Stephens' grounds, a very active, friendly insect, a small mite *Tyroglyphus phylloxera* which feeds upon the Phylloxera, busy at work on its useful mission.

Since this insect is now known to be at work in Ontario, and probably to a greater extent than we are at present aware of, a condensed account of its life history will probably be interesting to our readers. The figures are from Prof. Riley's excellent reports, and the facts given, mainly gleaned from the writings of this and other authors.

Its progress in Europe has been most alarming, inflicting untold losses in the wine-making districts. The destruction it has occasioned in France has been so great that it has become a national calamity which the Government has appointed special agents to inquire into; large sums of money have also been offered as prizes to be given to any one who shall discover an efficient remedy for this insect pest. At the same time it has made alarming progress in Portugal, also in Switzerland and some parts of Germany, and among vines under glass in England. It is a native of America, from whence it has doubtless been carried to France; it is common throughont the greater portion of the United States, and in one of its forms in Canada, but our native grape vines seem to endure the attacks of the insects much better than do those of Europe. Recently it has appeared on the Pacific slope in the fertile vineyards of California, where the European varieties are largely cultivated, and hence its introduction there will probably prove disastrous to grape culture. Already many vineyards are seriously affected, and it is said that some grape growers have had to root up hundreds of vines and destroy them, in consequence of the roots being so crowded with the lice. After the sad experience of European vineyardists it is not surprising that the grape-growers of California are much exercised over this subject. The phylloxera has also occurred in several of the Southern States.

This insect is found in two different forms: in one instance, on the leaf, where it produces greenish red or yellow galls of various shapes and sizes, and is known as the type *Gallaecola*, or gall-inhabiting; in the other and more destructive form, on the root, known as the type *Radicicola*, or root-inhabiting, causing at first, swellings on the young rootlets, followed by decay, which gradually extends to the larger roots as the insects congregate upon them. These two forms will, for convenience, be treated together.

The first reference made to the gall-producing form was by Dr. Fitch, in 1854, in the Transactions of the New York State Agricultural Society, where he described it under the name of *Pemphigus vitifoliæ*. Early in June there appear upon the vine leaves small globular or cup-shaped galls of varying sizes; a section of one of these is shown at *d*, figure 76; they are of a greenish red or yellow colour, with their outer surface somewhat uneven and woolly. Figure 75 represents a leaf badly infested with these galls. On opening one of the freshly formed galls, it will be found to contain from one to four orange-coloured lice, many very minute shining, oval, whitish eggs, and usually a considerable number of young lice, not much larger than the eggs, and of the same whitish colour. Soon the gall becomes overpopulated, and the surplus lice wander off through its partly opened mouth on the upper side of the leaf, and establish themselves either on the same leaf or on adjoing young leaves, where the irritation occasioned by their punctures causes the formation of new galls, within which the lice remain. After a time the older lice die, and the galls which they have inhabited open out and gradually become flattened and almost obliterated; hence it may thus happen that the galls on the older leaves on a vine will be empty, while those on the younger ones are swarming with occupants.

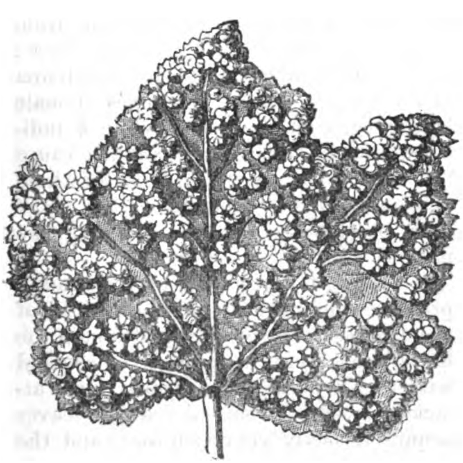

Fig. 75

These galls are very common on the Clinton grape and other varieties of the same type, and are also found to a greater or less extent on most other cultivated sorts. They sometimes occur in such abundance as to cause the leaves to turn brown and drop to the ground, and instances are recorded where many vines have been defoliated from this cause. The thin leaved varieties of grape suffer most, those with thick leathery foliage being seldom injured to any considerable extent. Such varieties as Concord, Hartford Prolific, Moore's Early, and Rogers' Hybrids are rarely injured by this leaf-inhabiting form of the insect. The number of eggs in a single gall will vary from fifty to four or five hundred, according to the size of it; there are several generations of the lice during the season, and they continue to extend the sphere of their operations during the greater part of the summer. Late in the season, as the leaves become less succulent, the lice seek other quarters and many of them find their way to the roots of the vines, and there establish themselves on the smaller rootlets. By the end of September, the galls are usually deserted. In figure 74 we have this type of the insect illustrated; *a* shows a front view of the young louse, and *b* a back view of the same; *c* the egg, *d* a section of one of the galls, *e* a swollen tendril; *f*, *g*, *h*, mature egg-bearing gall lice, lateral, dorsal, and ventral views; *i*, antenna, and *j* the two-jointed tarsus.

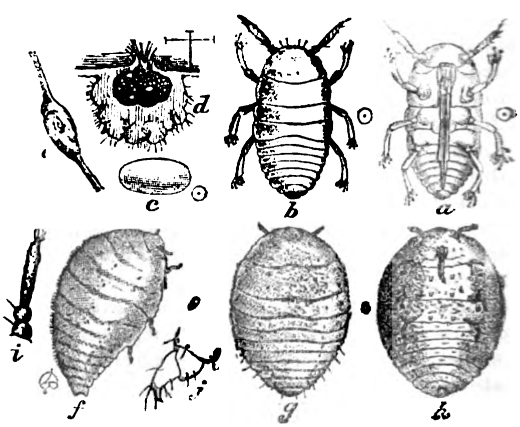

Fig. 76.

When on the roots, the lice subsist also by suction, and their punctures result in abnormal swellings on the young rootlets, as shown at *a* in figure 77. These eventually decay, and this decay is not confined to the swollen portions, but involves the adjacent tissue, and thus the insects are induced to betake themselves to fresh portions of the living roots, until at last the larger ones become involved, and they, too, literally waste away.

In figure 77 we have the root-inhabiting type, *Radicicola*, illustrated: *a*, roots of Clinton vine, showing swellings; *b*, young louse as it appears when hibernating; *c*, *d*, antenna and leg of same; *e*, *f*, *g*, represent the more mature lice. It is also further illustrated in fig. 78, where *a* shows a healthy root, *b* one on which the lice are working, *c* root which is decaying and has been deserted by them; *d d d* indicates how the lice are found on the larger roots; *e*, female pupa, seen from above; *f*, the same from below; *g*, winged female, dorsal view; *h*, the same, ventral view; *i*, the antenna of the winged insect; *j*, wingless female laying eggs on the roots, while *k* indicates how the punctures of the lice cause the larger roots to rot. Most of these figures are highly magnified; the short lines or dots at the side showing the natural size.

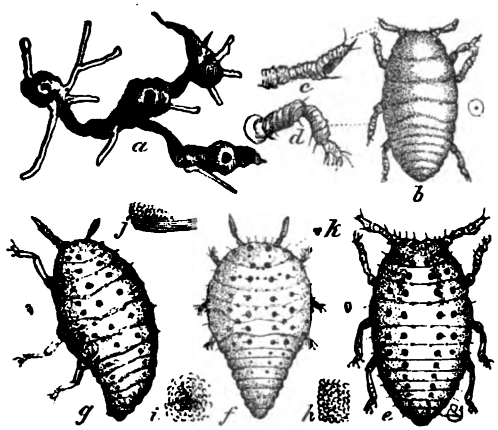

Fig. 77.

During the first year of the insect's presence the outward manifestations of the disease are very slight, although the fibrous roots may at this time be covered with the little swellings; but if the attack is severe, the second year the leaves assume a sickly yellowish cast, and the usual vigorous yearly growth of cane is much reduced. This is not to be wondered at when we consider the immense number of tiny mouths which are busily at work in all directions sucking the sap and thus depriving the leaves of their only means of subsistence. After a time the vine becomes more debilitated and eventually dies, but before this takes place, the lice, having little or no healthy tissues to work on, cannot find sufficient sap for their sustenance, hence they leave the dying vine and seek for food elsewhere—either wandering about under the ground among the interlacing roots of adjacent vines, or crawling over the surface in search of more healthy material to feed on. During the winter many of them remain torpid, and at that season assume a dull brownish colour, so like that of the roots to which they are attached that they are difficult to discover. They have then the appearance shown at *b* in figure 77. With the renewal of growth in the spring, the young lice cast their coats, rapidly increase in size, and appear as shown at *e*, *f*, *g*, in the figure; soon they begin to deposit eggs, these eggs hatch, and the young shortly become also egg-laying mothers like the first, and like them also remain wingless. After several generations of these egg-bearing lice have been produced, a number of individuals about the middle of summer acquire wings. These also, are all females, and they issue from the ground, and rising in the air, fly or are carried with the wind to neighbouring vineyards, where they deposit eggs on the underside of the leaves among their downy hairs, beneath the loosened bark of the branches and trunk, or in crevices of the ground about the base of the vine. Occasionally individual root lice abandon their underground habits and form galls on the leaves.

The complete life history of this insect is very curious and interesting, but would occupy too much space to fully detail here. Those desirous of pursuing this portion of the subject further, and of informing themselves as to the different modifications of form assumed by this insect in the course of its development will find the desired information given with much minuteness of detail in the 5th, 6th, 7th and 8th Reports on the Insects of Missouri, by C. V. Riley.

Remedies: This is an extremely difficult insect to subdue, and various means for the purpose have been suggested, none of which appear to be entirely satisfactory. Flooding the vineyards where practicable seems to be more successful than any other measure, but the submergence must be total and prolonged to the extent of from twenty-five to

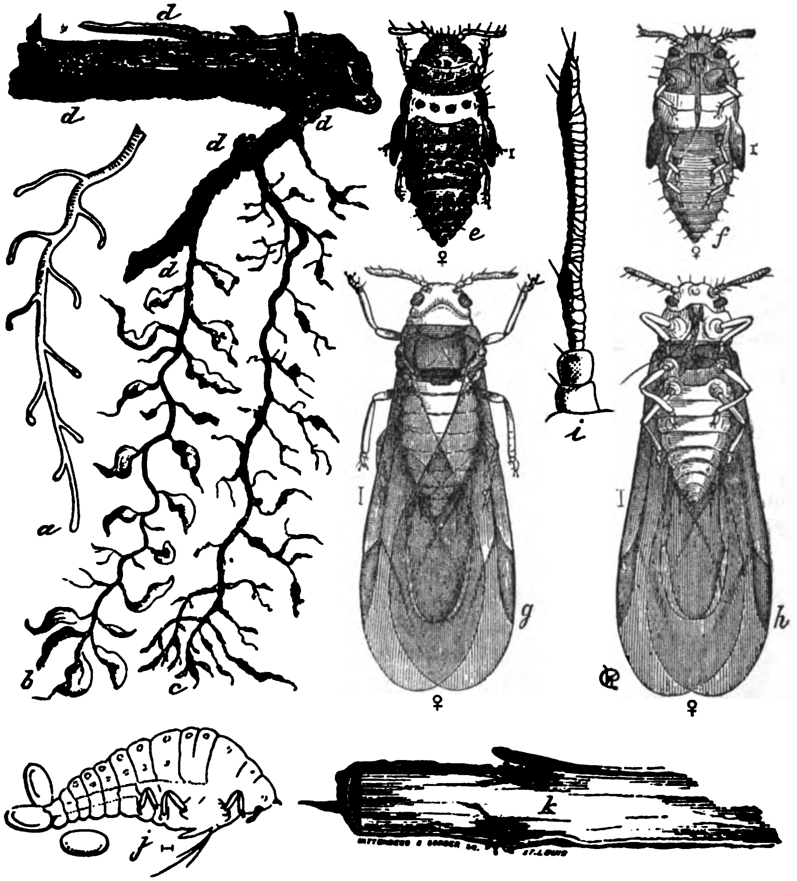

Fig. 78.

thirty days; it should be undertaken in September or October, when it is said that the root lice will be drowned, and the vines come out uninjured.

Bisulphide of carbon is claimed by some to be an efficient remedy; it is introduced into the soil by means of an augur with a hollow shank, into which this liquid is poured; several holes are made about each vine, and two or three ounces of the liquid poured into each hole. Being extremely offensive in odor and very volatile, its vapour penetrates the soil in every direction, and is said to kill the lice without injuring the vines. This substance should be handled with caution, as its vapour is very inflammable and explosive. Carbolic acid mixed with water, in the proportion of one part of acid to fifty or one hundred parts of water, has also been used with advantage, poured into two or three holes made around the base of each vine with an iron bar to the depth of a foot or more. Soot is also recommended, to be strewed around the vines.

It is stated that the insect is less injurious to vines grown on sandy soil; also to those grown on lands impregnated with salt.

Since large numbers of these insects, both winged and wingless, are known to crawl over the surface of the ground in August and September, it has been suggested to sprinkle the ground about the vines at this period with quicklime, ashes, sulphur, salt or other substances destructive to insect life. The application of fertilizers rich in potash and ammonia have been found useful, such as ashes mixed with stable manure or sal-ammoniac.

A simple remedy for the gall-inhabiting type is to pluck the leaves as soon as they show signs of the galls, and destroy them.

Several species of predaceous insects prey on this louse. A black species of Thrips with white fringed wings deposits its eggs within the gall, which, when hatched, produce larvæ of a blood red colour, which play sad havoc among the lice. The larva of a Syrphus fly, *Pipiza radicum*, which feeds on the root louse of the apple, see figure 79, has also been found attacking the Phylloxera. Another useful friend is a small mite, *Tyroglyphus phylloxera*, P. & R., see (Fig. 80), which attacks and destroys the lice, and associated with this is sometimes found another species, *Holophora arctata*, Riley, of a very curious form, reminding one of a mussel. In (Fig. 81), this minute friend is represented highly magnified in the different forms assumed by it.

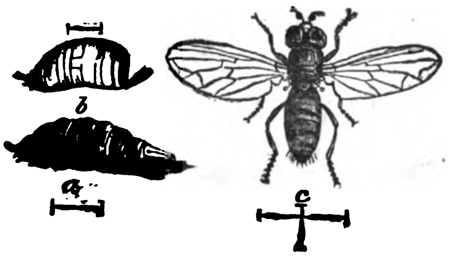

Fig. 79.

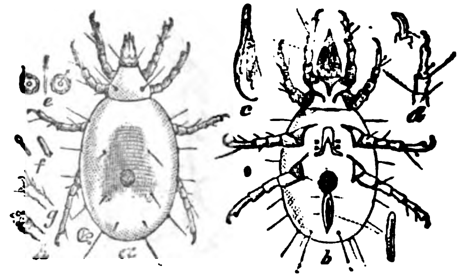

Fig. 80.

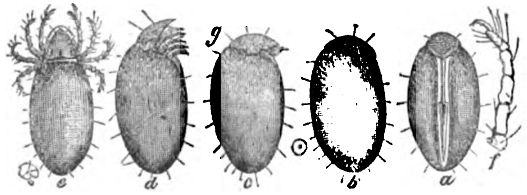

Fig. 81.

These lice are also preyed on by the larvæ of a Scymnus, a small dull coloured lady bird; also by several other species of the lady-bird family, and by the larvæ of lace-wing flies.

To guard against its introduction into new vineyards, the roots of young vines should be carefully examined before planting, and if knots and lice are found upon them, these latter may be destroyed by immersing the roots in hot soap suds or tobacco water.

Our native American vines are found to withstand the attacks of this insect much better than do those of European origin, hence by grafting the more susceptible varieties on these hardier sorts, the ill-effects produced by the lice may in some measure be counteracted. The roots recommended to be used as stocks are those of Concord, Clinton, Herbemont, Cunningham, Norton's Virginia, Rentz, Cynthiana, and Taylor. The Clinton, one of the varieties recommended, is particularly liable to the attacks of the gall-producing type of Phylloxera, but the lice are seldom found to any great extent on its roots, and the vine is so vigorous a grower that a slight attack would not produce any perceptible effects.

The Grape Berry Moth—Lobesia botana.

This is another grape pest which has appeared in our midst of late and promises to be a troublesome insect to contend with. It is an imported species, one which has long been injurious to grape culture in the south of Europe. The exact period of its introduction to America is not known, and it is only within the past few years that attention has been called to its ravages. When abundant it is very destructive; in some instances it is said to have destroyed nearly fifty per cent. of the crop.

During the past season it has been very abundant in the neighbourhood of London, there being very few vines the fruit of which has not been more or less injured. The young larvæ have usually been first observed early in July, when the infested grapes show a discoloured spot where the worm has entered. See (Fig. 82 c). When the grape is opened and the contents carefully examined there will usually be found in the pulp a small larva rather long and thin, and of a whitish green colour. Besides feeding on the pulp it sometimes eats portions of the seeds, and if the contents of a single berry are not sufficient, two, three, or more are drawn together as shown in the figure and fastened with a patch of silk mixed with castings, when the larva travels from one to the other, eating into them and devouring their juicy contents. At this period its length is about an eighth of an inch or more; the head is black and the next segment has a blackish shield covering most of its upper portion; the body is dull whitish or yellowish green. As it approaches maturity it becomes darker in colour and when about one-third of an inch long is full grown, see *b*, figure 82. The body is then dull green with a reddish tinge and a few short hairs, head yellowish green, shield on next segment dark brown, feet blackish, pro-legs green.

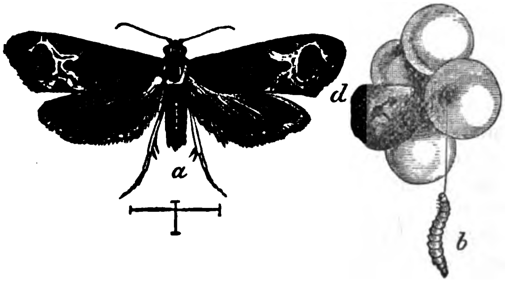

Fig. 82.

When the larvæ is full grown it is said to form its cocoon on the leaves of the vine, cutting out for this purpose an oval flap, which is turned back on the leaf forming a snug enclosure which it lines with silk; frequently it contents itself with rolling over a piece of the edge of the leaf, and within such retreats the change to a chrysalis takes place. The chrysalis is about one-fifth of an inch long and of a yellowish or yellowish brown colour, from which the moth finally escapes.

The perfect insect which is shown magnified, *a*, figure 21, measures when its wings are spread nearly four-tenths of inch across. The fore-wings are of a pale, dull bluish shade with a slight metallic lustre, becoming lighter on the interior and posterior portions, and ornamented with dark brown bands and spots. The hind wings are dull brown, deeper in colour towards the margin, body greenish brown. It is said that there are two broods of this insect during the year. We have never seen them at any other time than in the autumn when the grapes are approaching maturity.

Remedies—As it is probable the most of the late brood pass the winter in the chrysalis state attached to the leaves, if these were gathered and burned a large number of the insects would perish. The infested grapes might also be gathered and destroyed. This insect is attacked by a small parasite which doubtless does its part towards keeping the enemy in subjection.

The Clover Seed Midge—Cecidomyia leguminicola.

This new insect pest to which we refered at some length in the Report for last year, seems to be rapidly spreading. It has destroyed a considerable portion of the seed grown in the neighbourhood of London, an injury felt this year more than it would usually be on account of the light crop, resulting from an unfavourable season.

As stated last year, this insect is no doubt being spread by the dissemination of infested clover seed. The larva is very small, not more than one-hundredth of an inch long, and of a reddish or orange-red colour. When the seed is threshed these larvæ are mixed with it, and they remain in the larval condition all winter with the seed, and are sown with the seed in the spring. Once in the ground the insect finds all the conditions necessary for its full development, and before long it issues as a fly and enters on its work of destruction, producing two broods during a year. Farmers should exercise caution in the selection of their seed ; and seedmen should carefully examine the seed they sell, otherwise they may seriously injure the prospects of their customers by introducing and disseminating this pest in districts hitherto free from it.

The Hessian Fly—Cecidomyia destructor Say.

On 26th of July last, my attention was called to the wheat growing in the neighbourhood of London by one of our most intelligent and successful farmers, Mr. John Wallis, of lot 32, con. 4, London township, who had found evidences in his own fields of injury caused by an insect, which, on examination, proved to be the Hessian Fly. I at once called general attention to the subject by addressing the farmers of Ontario through the London and Toronto newspapers under date of July 28th, and soon became involved in an extensive correspondence on this subject. My impression as stated at the time with regard to the extent of injury to the crop on Mr. Wallis's farm, was, that it would prove to be a loss of about 20 per cent., an estimate which results have since shown to be rather under than over the mark. There were many other wheat fields about London worse than those of Mr. Wallis, and if with his careful farming—involving proper rotation of crops and thorough manuring—his loss was so large, it must have been much larger in proportion on many farms less judiciously managed.

As indicating the area over which the insect prevailed, the following extracts from correspondence are submitted : Mr. John Morrison jr., of Oban, Lambton Co., says, "In reply to your letter in the *Weekly Globe*, I would say, that our own fields are badly infested with the Hessian Fly, more than half the crop, I should judge, being injured ; other fields I have seen about here are not quite so bad but still injured apparently to the extent of from 20 to 40 per cent."

Dr. C. P. Pitcher, of Jerseyville, sent me samples of wheat containing the larva of the Hessian Fly from his district, and writes, "the enclosed samples of the work of the Hessian Fly I cut from a field of wheat on the farm of Mr. Zenus Weaver, in the Township of Ancaster, Co. Wentworth. Had my attention not been drawn to the subject by your letter in the *Globe*, I should not have investigated the matter. There is a considerable proportion of the wheat in this district crinkled down from this cause."

Mr. Roland W. Gregory, of St. Catharines says, "I herewith send you statement of my experience with the Hessian Fly in my present crop. About the middle of September last, I sowed a field of about seven acres of wheat, which I had fallowed and covered with manure, the field as I thought being in an excellent condition for a crop of wheat. The season being very dry and the soil not uniform in its character, varying from light sand to sandy loam, clay loam, and clay, the wheat did not come up evenly. On that part of the field where the wheat came up first and looked well in the fall, the Hessian Fly commenced working, and in the latter part of November I found one plant on which I counted nineteen of the small maggots, while in that portion of the field where the soil was poor the wheat came up later and escaped the fly, and the crop is now very heavy. In that part of the field so badly infested with it, nearly every stem had the insect in it in the flax-seed state."

Mr. James Hammond, of Hammond P. O., Perth Co., writes under date of 7th of August as follows: "I noticed some time ago that something was doing considerable damage amongst my fall wheat (silver chaff variety). I mentioned the fact to some of my neighbours, telling them that it appeared to be cut at, or near the ground, but they appeared to be equally ignorant with myself as to the cause, and I thought little more about it until I saw your letter in the last issue of the *Weekly Globe*, when I examined some stalks, and find from your description that it is the genuine Hessian Fly. I enclose herewith samples of the insect in stalk, from which you will be able to judge of the correctness of my conclusion." These stalks from Mr. Hammond contained the insects in the flax seed state.

Judging from these letters which may be taken as fair samples of the correspondence, the estimate formed was, I think, rather under than over the mark, and the aggregate loss to the farmers of Ontario from the depredations of this insect during the past season must be a very large sum, as the area of land under wheat was very extensive.

Through the kindness of Mr. John Wallis, I have been enabled to compare the weight and appearance of the grain in the ears of the injured stalks with that of those of the healthy ones. I find that 100 of the kernels from the healthy plants which presented a plump appearance and a firm structure weighed 120 grains, while the same number taken from diseased stalks present a shrivelled appearance and a structure much less firm, and weighed only 59 grains, a difference of a little more than 100 per cent. By late sowing as recommended in my annual address to the Entomological Society in August last, Mr. Wallis now has a field of fall wheat in excellent condition, occupying the same ground as that on which the wheat was most injured last season. In order to test the value of this recommendation, he has departed from his usual course of rotation of crop so as to give the insects a fair chance, and judging from appearances at the present time it promises an abundant yield.

HOMOPTERA.—THE HARVEST FLIES AND THEIR ALLIES.

BY JAMES FLETCHER, OTTAWA, ONT.

The Cicadæ or Harvest Flies belong to that order which is known to Entomologists under the name of Hemiptera, (from two Greek words ἡμι = half, and πτερόν = a wing).

It is to this order of insects, alone, that the name—bug—properly belongs. Although now generally applied to all kinds of insects, it appears formerly to have been used for any object of terror, real or imaginary, and also as a term of contempt for something disagreeable and hateful; we have a remnant of its original meaning in the word "bug-bear." Perhaps the name was applied more distinctively to the Hemiptera on account of the disgusting odour which many of the Heteropterous members of the order have the power of emitting when disturbed.

In their earlier stages the Hemiptera have what are known as Incomplete Metamorphoses—that is, they do not entirely change their conditions during each of the different periods of their existence, as the Lepidoptera and Coleoptera do, where there is first of all the egg that hatches into an active larva which when full grown passes into a quiescent pupal state, previous to the fully developed imago condition.

The pupæ of the Hemiptera are active and very similar to the larvæ; in fact the only noticeable change which takes place in the form of these insects, from the time the egg hatches until they attain the perfect shape, is a gradual development of their wing covers and wings, and the growth of their bodies which makes it necessary for them to frequently cast their skins. When all the transformations have been completed, the imagines (perfect insects) generally possess four wings; the superior pair or hemelytra which are attached to the mesothorax, have the basal part or *corium* opaque and of a leathery consistence and the apical portion membranous and transparent; the inferior pair are attached to the metathorax and are entirely membranous and generally transparent and capable of being folded when the insect is in repose.

The whole of these insects are *Suctorial*—that is, live on fluids. To enable them to do this their mouth parts consist of a more or less slender beak or *promuscis*, which varies according to the food or the circumstances under which they live. Those species which feed on animal food or under bark, have shorter and thicker beaks than those which derive their nourishment from vegetation, and as the former are for the most part beneficial and feed on other insects, this is a very important distinction for everyone to become familiar with. The beak consists of the labium, which is so modified as to form a hollow sheath, by having its two sides turned up, so that a deep groove is left in the middle of its upper surface, which acts both as a canal up which the juices on which the insect feeds flow, and also as a sheath for four delicate sharply pointed *setæ* or bristles which are actually the jaws and maxillæ modified for a special use. It is with these instruments that the insect punctures the plant or animal from which it derives its food.

The insects comprised in this order are of the most anomalous shapes, and there are embraced within its limits some of the most curious and wonderful forms of insect life. Their geographical range is very wide, for there is hardly any part of the globe of which the land and water do not produce their own peculiar forms. The number of species classed within this order is said to reach nearly 10,500, which are about equally divided between the two sub-orders into which the Hemiptera are divided. These two sub-orders are called Hemiptera-heteroptera and Hemiptera-homoptera, which again are divided into divisions and sub-divisions, and the latter of these are distributed into families which contain the various genera and species.

It was Latreille who divided the Hemiptora into these two divisions: "The Homoptera are the higher in rank, as the body is more cephalized, the parts of the body more specialized, and in the Aphidæ which top the series, we have a greater sexual differentiation, the females being both sexual and asexual, the latter by a budding process, and without the interposition of the male, producing immense numbers of young which feed in colonies. The Heteroptera, on the other hand, have the body less compactly put together, the abdomen and thorax are elongated, the head is small compared with the rest of the body, and the species are large (a sign of degradation among insects) and several families are aquatic, indicating a lower grade of development, while representatives of these were the first to appear in geological times. Their affinities are with the Orthoptera and Neuroptera, while the Homoptera whose bodies are more cylindrical ally themselves with the first and higher series of sub-orders."—(Packard).

For convenience sake we will take a short glance at the Heteroptera first, and then pass on to the Homoptera.

In the Hemiptera-heteroptera (ἕτερος = various, πτερα = wings) the hemelytra are thick and opaque at the base, but membranous and translucent at the tips; they lie horizontally on the top of the back and cross each other obliquely so that the translucent part of one overlaps the same part of the other. The underwings which these cover are entirely membranous; the head is horizontal and bears on its front part the articulated promuscis or beak which is bent down and carried underneath the breast. Between the wings there is a scutellum which is generally triangular, but which is sometimes so large as to cover the whole of the upper side of the body, leaving only the margins of the fore-wings visible. (See figure 83). The modes of life among these bugs are very varied; animals, birds, insects and plants are all liable to their attacks, and they are sometimes exceedingly destructive. For the most part they are found upon the plants on which they subsist; but others again feed on weaker insects found in similar situations. They continue active and require food during all their stages. The larvæ are distinguished by the total want of any appearance of wings; whilst in the pupæ the rudiments of these limbs appear on the back of the thorax. All of these insects have ocelli or simple eyes on the front of the head between the two large compound eyes, but these, like the wings, are only developed in the perfect state.

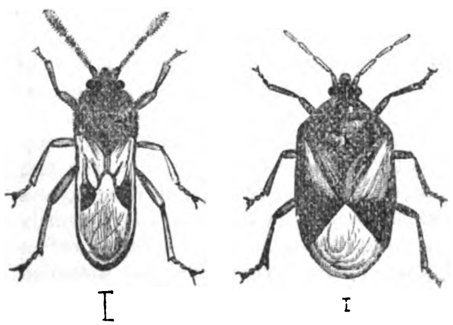

Fig. 83.

The great entomologist, Latreille, divided this order into two primary sections to which he applied the names of *Geocorisa* or Land Bugs, and *Hydrocorisa* or Water Bugs. Westwood, however, improved on this arrangement by calling the former of these *Aurocorisa*, or Air Bugs, because there were certain species (Hydrometridæ) which had to be included in it, but which do not live on land, but pass the greater part of their time on the water, although they never dive below the surface. These species were also included by Latreille in his Geocorisæ and called Ploteres. Westwood's arrangement of Latreille's system was as follows:—

(1.) Hydrocorisa, or those which reside in water.

(2.) Aurocorisa, or those which breathe the free air.

1. *Hydrocorisa.*—There are many species of water bugs which differ very much in appearance, but they all have the antennæ very short and concealed in cavities beneath the eyes, their legs are modified according to their mode of life: the anterior pair are short and fold close to the body, forming a pair of claw-like organs with which they seize their prey; the other legs, particularly the last pair, are generally elongated and ciliated with stiff bristles which spread out when the limb is driven backward through the water and so act as the blade of an oar; of course when drawn forward they pass through the water easily. The eyes are often of a large size. Nearly all the species in this group are of a dull inconspicuous colour. They have to come to the surface of the water frequently to obtain a supply of atmospheric air, which they carry down to the bottom again in different ways; among the Notonectidæ it is carried in a space beneath the closely fitting hemelytra and the upper surface of the abdomen, where it is retained by means of rows of hairs. It is into this cavity that the spiracles or mouths of the breathing tubes open.

2. *Aurocorisa.*—In this section the insects may be generally recognized by the greater length of the antennæ, and by the legs being fitted for running and walking and not for swimming. Good examples of these insects are found in the destructive Squash Bugs and Chinch Bugs, as well as in the useful Spined Soldier Bugs and Rapacious Soldier Bugs. This, too, is the section which boasts the possession of that highly objectionable creature, the bed-bug (Acanthia lectularia), but it also includes the Reduvii, a family of cannibal insects, one species of which, R. personatus, is known in Europe to feed on these, and which family is represented in Canada by some useful species.

The other sub-order of the Hemiptera is called Hemiptera-homoptera (ὁμός = like, πτερα = wings), or same winged, because both the upper and under pairs of wings are of a similar character; both pairs are membranous, generally transparent and net-veined, the upper larger than the lower. The wings do not lap over each other when the insect is in repose as is the case among the Heteroptera, but are much deflexed at the sides and lie over the back like the roof of a house. The body is generally thick and convex, rather than depressed, and this partly accounts for the deflexed position the wings take when not in use. With few exceptions the antennæ are very short and bristle like. The face is either vertical or slopes obliquely under the body, so that the beak, which is composed of three joints, two short ones and one very long one, is set rather far back and issues from the under surface of the head close to the breast. In nearly all it is long and slender, as they all feed entirely on vegetable juices.

Within the limits of this sub-order are included some very grotesque and curious forms, and some which at first sight are apparently very dissimilar; but which, on a careful examination can easily be recognised as belonging to the same group. There are the Musical Cicadæ, the well-known Lantern-flies, the active, strangely-formed little Tree-hoppers and Leaf-hoppers, the Cuckoo-spit insects or Frog-hoppers, the lively Psyllidæ, the destructive Aphides or Plant-lice, with their remarkable transformations, and the extraordinary Coccidæ, or scale insects, which bear a closer resemblance to vegetable excresences than to living animals.

None of the species have more than three joints of the feet, and Mr. Westwood considered this such an important character that he based his system upon it, dividing them into three sections:—

1. Trimera. Tarsi three jointed; antennæ minute, setigerous; wings areolate.
2. Dimera. Tarsi two jointed; antennæ, filiform, 5 to 10 jointed; wings sub-areolate.
3. Monomera. Tarsi one jointed; antennæ, 6 to 25 jointed; wings not areolate.

In the first of these divisions the Cicadæ or Harvest flies find their appropriate place —in fact the first section of Westwood's arrangement corresponds with Linné's genus Cicada, or Latreille's family Cicadaires. The name of the Cicadæ is supposed by some to be a hybrid word derived from the Latin *Ciccum* = a thin skin, and the Greek ἄδειν = to please, in reference to its song; others derive its name from the Latin words *Cito Cadat*, implying that the perfect insects are short-lived. The Cicadidæ are the largest insects in the sub-order. In Westwood's Arcana Entomologica, Pl. 51, there is a figure of a gigantic species (*Cicada Imperatoria*, Westwood) which measures eight inches and a quarter between the tips of the outstretched wings, and in my own collection I have a very beautiful Indian species which measures six inches. This latter belongs to a group of the Cicadidæ, in which the wings are opaque and more or less coriaceous; the upper wings are of a dull, reddish black, with the veins of a slightly lighter shade, and across the middle of them there is a broad white band three-sixteenths of an inch wide; the rest of the upper surface is black, with the exception of a bright orange band across the prothorax. The eyes and the abdomen are a rich brown and the underwings a deep velvety black.

The Cicadidæ have the head short and broad with two large prominent eyes and three ocelli placed in a triangle between them; usually the wings are completely membranous, of a uniform consistence and delicately transparent, with few but distinct nerves. There are, however, a few exceptions to this rule, as in the Indian genus Polyneura, where the apical division of the wings is very thickly reticulated; and in a small group of the Cicadæ where the hemelytra are wholly, or in part, of a coriaceous nature. The abdomen is short and pointed, and the legs are short, the anterior femora are much thickened and toothed beneath. The ovipositor of the female is a very interesting object. This organ, which is the instrument with which the female places her eggs in a safe and proper asylum to wait until they are hatched, is lodged in a sheath which lies in a groove of the last ring of the abdomen. It is of equal thickness throughout, except at the tip, where it is slightly enlarged and angular. On each side it bears a set of nineteen sharp teeth, very fine at the point, and from that gradually increasing in size. The sheath is composed of two horny pieces, slightly curved, and ending in the form of a long spoon, so that the concave or hollow part may receive the convex or rounded part of the ovipositor. On examining this auger, for such it really is, under the microscope, it will be found to be three pieces most beautifully fitted together—two outer ones which have an alternate and separate motion, and on the outside edges of which the rows of teeth before mentioned are situated, and another fixed single piece, in between the other two, at the back, to which they act as a sheath, but which in turn supports and keeps them in their proper place by means of two internally-dilated lateral grooves, which receive the dilated edges of the serrated pieces, and in which these slip up and down. This last supporting dorsal-piece has a deep groove down its centre, and it is thought to consist of two separate pieces firmly soldered together, but which have not the slightest motion independent of each other. This instrument is composed of a hard horny substance called chitine, the same as are the stings of bees and wasps, and the ovipositors of Ichneumon flies. The auger of the Cicada then consists of two sharp saws which work alternately, and a central supporting dorsal-piece which holds them in their place and strengthens them. This instrument somewhat resembles the saw of the saw-flies, but as it has slightly different work to perform it bears corresponding modifications. It would, however, be impossible to conceive anything more exactly fitted for their required uses than these beautiful organs are.

The most peculiar characteristic of this family however consists in the structure of the musical instrument with which the males make the trilling sound for which they have been famous since ancient times. These organs are internal, and consist of two stretched membranes which are acted upon by two strong muscles, and the sound issues from two holes beneath two special expansions of the metasternum, which both cover up and protect these tympana or sound organs, and also act as sounding boards. The song varies much in the different species, and it would appear that the voice of the European one must have a much more grateful tone than that of his American cousin which we know, for we read in Kirby and Spence that the song of the Cicada has been a favourite theme in the verses of every Grecian bard from the time of Homer to Anacreon. In Westwood's "Arcana Entomologica" the following translation of Anacreon's ode to the Cicada is given:—

Happy creature! what below
Can more happy live than thou?
Seated on thy leafy throne,
(Summer weaves thy verdant crown,)
Sipping o'er the pearly lawn
The fragrant nectar of the dawn;
Mirthful tales thou lov'st to sing,
"Every inch" an Insect King:
Thine the treasures of the field,
All thy own the seasons yield;
Nature plants for thee the year,
Songster to the shepherds dear:
Innocent, of placid fame,
Who of men can boast the same?
Thine the lavished voice of praise,
Harbinger of fruitful days;
Darling of the tuneful nine,
Phœbus is thy sire divine;
Phœbus to thy notes has given
Music from the spheres of heaven:
Happy most as first of earth;
All thy hours are peace and mirth;
Cares nor pains to thee belong,
Thou alone art ever young;
Thine the pure immortal vein,
Blood nor flesh thy life sustain;
Rich in spirits—health thy feast;
Thou'rt a demigod at least.

These insects are also emblematically represented in the hieroglyphics of Egypt as priests—"They were called Tettix by the Greeks by whom they were often kept in cages for the sake of their song. Supposed to be perfectly harmless and to live only on the dew, they were addressed by the most endearing epithets and were regarded as all but divine. One bard entreats the shepherds to spare the innoxious Tettix, that nightingale of the nymphs, and to make those mischievous birds—the thrush and blackbird—their prey. Sweet prophet of the summer, says Anacreon, addressing this insect; the muses love thee; Phœbus himself loves thee, and has given thee a shrill song; old age does not wear thee out; thou art wise, earth-born, musical, impassive, without blood; thou art almost like a God. So attached were the Athenians to these insects that they were accustomed to fasten golden images of them in their hair, implying at the same time a boast that they themselves, as well as the Cicadæ, were *Terræ filii.* They were regarded indeed by all as the happiest as well as the most innocent of animals—not, we will suppose, for the reason given in the couplet by the saucy Rhodian bard, Xenarchus, where he notices the peculiarity of the males alone being possessed of the power of singing, and says:—

'Happy are the Cicadæ's lives,
Since they all have voiceless wives.'"

That the Grecian Cicadæ had more musical notes than ours is proved by the fact that its song and the music of the harp were both called by the same name *τερετισμα.* The Cicada was the emblem of the Science of Music, which was accounted for as follows:—When two rival musicians, Eunomus and Ariston were contending on the harp, the former broke a string and would have been beaten but a Cicada flew down, and settling on his harp, supplied with his voice the missing string and gained him the victory. At Surinam there is a species which is still called *Lierman,* from a supposed resemblance between the sound of the harp or lyre and its song.

Virgil accuses a species found in Italy of bursting the very shrubs with its voice. As far as our own species are concerned, too, I fear no one but an enthusiastic Entomologist, could persuade himself that he found anything very pleasing in the song. I know of nothing more similar to that of *C. pruinosa,* the Frosted Harvest fly, than the noise of a scissors-grinder's wheel. The short carol seems to be produced with a tremendous effort, slowly at first, and gradually rising in intensity of pitch, until at a certain point it begins to descend rapidly, so that one might suppose, if the chorister made the noise with his throat, that he had been seized by that member and were being strangled.

The Dog-day Cicada, or Frosted Harvest fly, which is known under the name of *C. canicularis*, as well as that given above, is by far the commonest species in Canada. It is a large handsome fly, sometimes over two inches in length from the front of the face to the end of the hemelytra. The head is black and prettily variegated with green and brown markings; it is very wide, short and transverse; the eyes are prominent, and the thorax is broad and also ornamented with green and brown markings. The wings are transparent and slightly hyaline. The outer edge and the veins of the basal portion are green for about one-third of their extent and deep brown for the remainder; towards the apex of each hemelytron there is a brown W shaped mark. This insect, which is to be heard on hot days throughout the whole summer, is tolerably common in Canada, but is somewhat difficult to capture. In passing through the rocky country between Lake Superior and Manitoba about the middle of last September, I heard many of these flies trilling out their shrill notes. The specific name *pruinosa* = frosted, is given on account of the newly-evolved imagines being thickly covered beneath their abdomens with a white powdery matter, which gradually gets rubbed off as the insects get older.

In the United States this Cicada is carried off by large burrowing wasps or hornets as food for their young. These wasps are exceedingly handsome and are called *Stizus grandis* and *S. speciosus*. I have a specimen of the former of these which was captured in the act by Mr. A. H. Moore in the Smithsonian grounds at Washington. It measures one inch and three-quarters from the forehead to the tip of the abdomen, and possesses a large formidable sting with which these insects paralyze their victims previous to storing them away as food for their progeny. In the American Entomologist, vol. 1, N.S., there is a most interesting account of the instinct displayed by *S. speciosus* in availing itself of a favourable wind to transport its victims to its burrows, which, on account of their large size compared with its own, it would be unable to do without some assistance.

Cicada rimosa, Say.—The Creviced Harvest fly is the smallest species we have; it generally appears a few weeks previous to *pruinosa*, and in the United States at the same time as *C. septendecim*, which it resembles somewhat and with which it has been frequently confounded. It has the outer edge of the wings, parts of the legs and the edges of the abdomen of a yellowish brown, but not so bright as in *septendecim*, and the eyes are dark. In size, too, it is much smaller.

Cicada septendecim, L.: the Seventeen-year Locust.—This remarkable insect, concerning which so much has been written, is also said to have been found in Canada. It is a slighter insect than *C. pruinosa*, and its colours are much brighter; the body is black and the eyes reddish orange, the legs and under-side of the abdomen are orange, as are also the outside edges and veins of the wings.

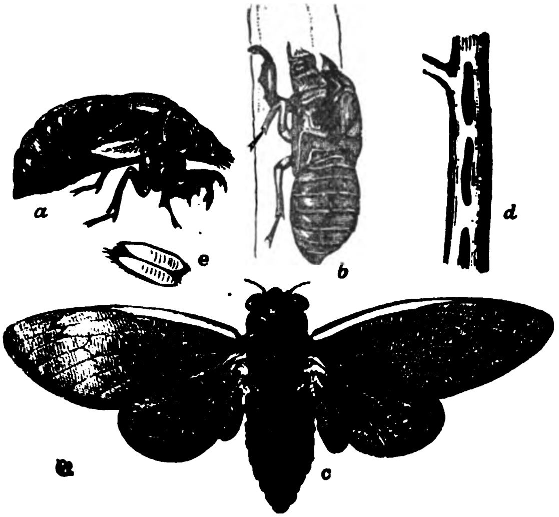

Fig. 84.

Fig. 84, copied from Prof. C. V. Riley's first report of Missouri, gives a very good idea of the appearance of this insect in its various stages: *a* represents the pupa which is honey-yellow in colour; *b*, the cast-off skin from which the perfect insect has emerged through the rent in the back. When the larva is first hatched from the egg it presents the appearance shown at Fig. 86, and is an active little creature which moves its long eight jointed antennæ as dexterously and rapidly as does an ant; the mature larva differs considerably from the newly-hatched one, but principally in having shorter antennæ; *c* represents the fully developed fly, and *d* a piece of a young branch which has been bored by the ovipositor of the female for the reception of her eggs, which are shown at *e*. As its name implies, this insect generally requires seventeen years to complete its transformations; this fact was pointed out many years ago by the botanist Kalm.

Prof. Riley, who has given this species a great deal of study, and discovered many interesting points in its history, was the first to work out the problem of its periodical appearances. He found that there are also thirteen year broods and that both sometimes occur in the same locality, but that in general terms the thirteen year brood might be called the southern form, and the seventeen year the northern form; at the two limits of their respective ranges these broods over-lap each other. The shorter-lived form he called provisionally *C. tredecim*. It was the existence of this brood which caused Entomologists to doubt the propriety of Linné's name, until Prof. Riley cleared the matter up, because they could not make the dates of its periodical visits correct when calculating each appearance as occuring at the end of every seventeen years in any one locality. In his first Missouri Report he gives a full account of his investigations, and relates that "it happened that one of the largest seventeen year broods occurred simultaneously with one of the largest thirteen year broods in the summer of 1868. Such an event, so far as regards these two particular broods, has not taken place since the year 1647, nor will it take place again till the year 2089.

There are absolutely no specific differences between the two broods other than in the time of maturing. Another interesting discovery was, that there is a dimorphous form which appears with both these broods. It is much smaller and differs in many important points from the ordinary form. The colour is much darker, it has an entirely different voice, appears a fortnight sooner, and the two forms never copulate. This form was described by Dr. J. C. Fisher in 1851, as *C. Cassinii*, but the specific differences are not considered to be sufficiently well defined to give it the rank of a species.

The perfect insects make their appearance in the United States in the beginning of June, and last for about a month, and as they generally appear in vast numbers, they do considerable damage. Local changes take place so rapidly now, and these flies take so long to perfect themselves, that frequently roads are built and paths made in places where, perhaps seventeen years before, when they were hatched from the egg, it was virgin soil. This contingency frequently makes it necessary for them to bore through hard roads and between stones well beaten down; and that they do this, the honeycombed state of the ground bears ample testimony. When the larvæ, in which stage the insect passes the greater part of its life, is full grown, it works its way up towards the surface, and then turns to the pupa state, which only lasts a few days. When they are ready to emerge they leave their burrows as evening draws on, and crawl up on to some object elevated above the ground, such as a fence or the stem of a plant; this they grasp firmly with their claws, the skin of the back bursts and ten minutes afterwards the perfect insect has entirely freed itself of all encumbrance; the wings soon develop, but it is not for three or four days that the muscles harden sufficiently for them to assume their characteristic rapid flight and shrill song. As is the case with several other insects the males make their appearance some days before the females, and also leave sooner. The skin of the pupa (Fig. 84 *b*) retains its perfect shape for many months after the fly has left it. Those of *C. pruinosa* are very common here in a dry rocky wood. Prof. Riley also figures a remarkable chamber built up by the larva of this species in localities where the soil was low and swampy, and in which was found the pupa awaiting the time of its change to the winged state. These chambers were first noticed by Mr. S. S. Rathvon at Lancaster, Pa., and are from four to six inches above the ground, with a diameter of one inch and a quarter. (See fig. 85.) When ready to emerge the insect backs down to an orifice which it left in the side of the structure, even with the surface of the ground, issues forth and undergoes its transformations in the usual manner. After pairing the females deposit their eggs in the twigs of different trees—oak, hickory, and apple chiefly, but also in many other kinds, and even sometimes in coniferous trees. The eggs are placed at the bottom of grooves bored by means of the ovipositor. The insect settles on a branch of moderate size, which she clasps on both sides with her head towards the end, then bending down the piercer at an angle of 45 degrees, thrusts it obliquely through the bark and fibres into the very centre of the twig; after this nidus is finished she deposits the eggs in two rows with a narrow strip of wood left between them; there are from ten to twenty eggs in each groove. It takes about fifteen minutes to prepare a groove and fill it with eggs. There are sometimes as many as twenty grooves made in a branch by one insect, and each female has a stock of from 500 to 700 eggs. It frequently happens that these branches bearing the eggs, are so weakened by the operation, that they are broken off by the wind, and fall to the ground; when this is the case the eggs never hatch, for, like those of many of the gall flies the moisture of the living wood is necessary for their proper development, as shown by the fact that they are much larger just before hatching than when first deposited about six weeks before. When hatched, they throw themselves fearlessly from the tree to the ground, and from their small size, one line in length, they are very light and receive no injury. The newly-hatched insect is shown in fig. 86. They immediately burrow down into the ground and feed on roots. There are numberless stories in the newspapers every year about people being stung by the Cicadas, but none have ever been satisfactorily proved. If these tales be true the injuries could, of course, only be inflicted by the beak, fig. 87 *a*, or by the ovipositor *b*, but I fancy that these tales are about as true as the newspaper accounts of the "frightful poisonings" yearly laid at the door of the larva of the Tomato Sphinx:

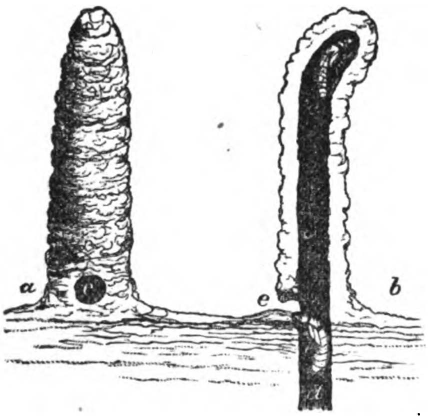

Fig. 85.

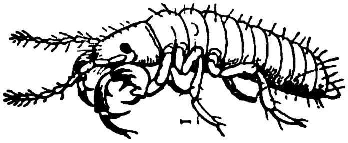

Fig. 86.

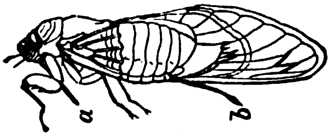

Fig. 87.

"The song of this species is in one uniform musical key, which is *C* sharp."

Of the Fulgoridæ or Lantern flies there is a small species found in the United States called *Scolops dulcipes*, which has the front part of the head much prolonged and projecting upward like a thin curved horn. Prof. T. Glover found it not uncommon in July and September in the neighbourhood of Maryland Agricultural College. None have so far been recorded from Canada.

Among the Cercopidæ are found several strange genera, including the Tree-hoppers, Frog-hoppers and Leaf-hoppers. The Tree-hoppers (Membracis of Harris) are dull-coloured little insects which are to be found on the stems and leaves of plants during the summer and autumn months. Many of them have very grotesque forms with the face nearly vertical, the thorax tapering to a point behind, and so much enlarged as to cover the greater part of the upper side of the body; it is too frequently ornamented with blotches or stripes of another colour. These insects are well protected from detection by their enemies, both by their habits and by a striking resemblance which frequently exists between their shapes or marking and those portions of the plants which they infest. They are mostly angular in outline, some have the upper surface, which consists chiefly of the enlarged thorax, rough and dark coloured like the bark of a tree; others have horn-like processes resembling the thorns of a plant; this simile is further carried out by a habit they have of sitting still for hours on the stem of a plant with their heads all turned one way —upwards towards the end of the shoot. Some again are protected by their colours, as the green species which are found among foliage, or the brown and mottled ones which frequent the bark and stems of trees. Although, as stated above, they will sit still without moving for hours together, they are by no means asleep and are very difficult to capture. A slight movement is sufficient to make them spring from their resting-place with great quickness, and they settle again so suddenly that it is no easy matter to follow them. There is no class of insects which proves so well as these do the advantage of an Entomologist being to a certain extent an artist, for the colours of many of these interesting little insects are so fugitive that many of them lose their brightness almost before they are moved from the setting boards, and for a thorough study, paintings of them as caught are essential. We have several species in Canada, of which the following are some of the most interesting of those taken in the vicinity of Ottawa. They were most of them taken in the beating net, of which an illustration was given in the Canadian Entomologist for 1878, at page 62. I may mention that this net has received a thorough trial at the hands of my colleague, Mr. Harrington, and myself, and we have found it most satisfactory, and by far the most convenient pattern yet brought to our notice.

Enchenopa binotata, Say: the two-spotted Tree-hopper.—This is perhaps the prettiest and most curious little insect we have of this order. Its shape, in profile, is exactly that of a partridge with outstretched neck and head. It also has the habit of congregating in small clusters on the stems of the plants it feeds upon, and as there are generally specimens in all the different stages of growth, they may be likened to a brood of those birds. Sometimes the perfect insects form in single file along a branch, when they look like thorns or excresences of the bark. The long neck-like extension is only a prolongation of the thorax, the head of course is underneath and furnished with a promuscis or beak for sucking sap. The general colour is a dark brown, and there are two yellow spots separated by a black space on the ridge of the back (thorax). The total length is not more than four lines from the apex of the wings to the tip of the thoracic protuberance. One of the most remarkable characteristics of these insects is found in the shape of the four anterior tibiæ, which are very broad and flat. It is not an uncommon species, and is found on several trees such as hickory, butternut, locust and *Celastrus scandens*.

Smilia vau, Harris.—The V-marked Tree-hopper is also found on the hickory and butternut. It is about three lines in length with the thorax, which forms an arched crest over the body, rounded in front and keeled from the middle backwards to the tip. It is of a brown colour, and has its back ornamented with V-shaped marks.

Entilia carinata, Forster: the keeled Tree-hopper.—This species I have found plentifully on the common sun-flower (Helianthus annuus) clustered together in small families beneath the leaves. They are about one-fifth of an inch long and have two humps on the back, the space between them being in the shape of a complete semi-circle. The colours vary much: in some specimens it is a light cinnamon with wavy lines running to the posterior angle of the very large thorax. In others it is a dark reddish brown with a broad subterminal white band, the front is almost perpendicular and black.

Ceresa bubalus, Fabr.: the Buffalo Tree-hopper.—The colour of this species is a beautiful green. It is very triangular in shape, and has a pair of sharp curved spines, one on each side of the thorax, which somewhat resemble the horns of a buffalo, and from which fact it takes its specific name. It is a very active species, and flies a long distance when disturbed. I have taken it on young apple-trees and rose-bushes. The eggs are said to be deposited in a curved row, in a series of punctures made by the ovipositor of the female in the bark of several trees. It has been accused of injuring grape-vines by puncturing the bark of the stems for this purpose.

C. diceros, Say.—The two-horned Tree-hopper much resembles the last in shape and size, but has a brown spot on each side of the thorax behind the horns, and a bar across the middle of the back and the posterior tip, of the same colour.

Telamona ampelopsidis, Harris.—Is a rather large Tree-hopper, sometimes measuring half an inch in length. It is found on the Virginian Creeper (*Ampelopsis quinquefolia*) and is very much the same colour as the bark of that plant. The thorax is raised up in the middle into a square hump and is crossed with three, more or less distinct, brown bands. I have taken this insect in the month of July.

In some of the Cercopidæ the face slopes downwards towards the breast; the thorax is of moderate size, and never extends much beyond the base of the wing-cases, and does not conceal the head when viewed from above.

The Frog-hoppers (Amphrophora), also called Cuckoo-spits, are those insects which have the habit of enveloping themselves in the remains of the liquid food which they suck from plants and then eject again in the form of a frothy substance with which they entirely cover themselves, in the same way that the larvæ of some beetles, to a less extent, cover their bodies with the remains of their solid food. In the perfect state, to which they attain late in the summer, they are very active insects, mostly of dull colours, and are to be found in grass and low herbage; one species, however, *A. parallela*, Say, is the insect which forms the small masses of foam, which may be seen on the young branches of pine trees in June and July. It is an oval brown insect about half an inch long with a white spot in the middle of each hemelytron. The popular names of these insects are taken from an absurd idea, which actually dates back to the days of Aristotle, and which is fully believed in by many people even to-day that the frothy excrementitious secretion was the spittle of the cuckoo or the frog.

Clastoptera proteus, Say, is a pretty little short and broad insect, roundish in shape and about two lines in length, having the head and thorax black with three bright yellow stripes; the hemelytra are of a peculiar shape, being deeply grooved in the middle and having the apices turned abruptly down; they are also marked with two short oblique yellow stripes, running from the shoulders to the middle of the back, and at the tip of each wing-cover there is a black spot. This species is said to feed on the cranberry and blueberry.

C. obtusa, Say, found on hickory, is a rather larger species of a much less conspicuous colour, being brownish grey, and having the hemelytra veined and spotted with brown towards the apex.

The Leaf-hoppers (Erythroneura).—There is no better known example of this genus than that dreadful little pest—the grape-vine leaf-hopper *E. vitis*, which in some years will entirely spoil a whole crop of grapes by destroying the leaves just when the berries are half formed. This annoying little fly is almost rendering impossible the cultivation of the ornamental Virginia Creeper in this city.

The grape-vines do not appear to have suffered so much, although the havoc among these has been very great. The insect that causes all this mischief is really a most beautiful little creature. It is yellow with two red bands across the wings. (See Fig. 88). In the larva state it is bright crimson and has a very curious sidelong motion like a crab. The perfect fly nearly always settles underneath the leaf and sucks the sap from the parenchyma by means of its little trunk. The leaves first turn white, in patches, and then fall off. When large numbers of these flies spring from the leaves, as they will if the foliage is moved, they make quite a perceptible sound like rain. I have found them exceedingly difficult to combat, and really think the only way is to disturb them at night and hold a torch for them to fly into. There are a great many species of this genus in Canada, one of which is very troublesome to the apple. These flies are generally, but erroneously, called Thrips.

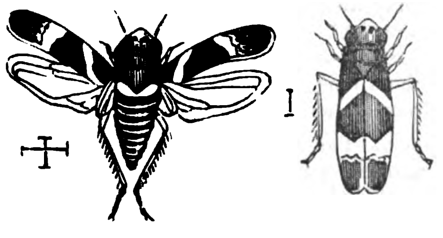
Fig. 88.

The second section of the Homoptera is known as Dimera, or those with two jointed feet. In this section we find very much smaller insects with antennæ longer than the head and in the winged individuals four wings ordinarily all of the same membranous texture. There are only two genera Psyllidæ and Aphidæ. The Psyllidæ or Flea-lice are small insects found on leaves and in some species raising galls. Although several kinds are known to occur, almost every tree having its own species, very few have been described. They have rather long antennæ terminated by two slender bristles; the beak is short and triarticulate, and the eyes are lateral and prominent as in the Cicadæ. On the front of the face are three ocelli placed in a triangle, the posterior ones quite close to the eyes.

The larvæ and pupæ have the body very flat, and in some species as *Psylla celtidis-mamma*, Riley, live in galls. I exhibited at the last annual meeting of the Society in Montreal specimens of the galls and pupæ of this species, and Prof. Riley then kindly informed me of its proper name, and told me where the only printed description could be found, namely, in an article written by himself for Johnson's "New Universal Cyclopædia," under the head of "Galls." For the benefit of our members I reproduce this in full:—
"The Flea-lice produce galls of various shapes and sizes on the stems and leaves of the Hackberry (Celtis). In life habits they differ from all the other gall insects, and agree with their nearest relatives, the Plant-lice, only in being the architects of their own galls. The egg, glued in spring to tender leaf or twig, soon hatches, and under the irritation caused by the young Psylla the gall soon embeds it. Within this gall the insect dwells till it has acquired the pupa state, which is generally by the time the leaves begin to turn and drop, then by means of certain horny spines or thorns at the end of its body, this pupa works its way out of its prison, and once out soon gives forth the perfect fly. The galls made by these Flea-lice are generally woody. Most of them are yet undescribed. *P. celtidis grandis* (Riley, M.S.) makes on the leaf-stalks a large grayish yellow swelling, which is an exception in being polythalamous. The few cells it contains are more or less filled with a white flocculent matter secreted by the insect." The perfect insect of *P. celtidis-mamma* appears in September and passes the winter in the crevices of the rough bark of the hackberry on which it underwent its preparatory stages, and adjacent trees. On November 24th last, I collected several specimens in a torpid state. The males are about one-eighth of an inch in length, and the females about one-third larger. The wings are deflexed at the sides of the body, and the hemelytra, which are rounded at the tips, are traversed by three strong nerves (the costal, median, and sub-median), each divided but once and disposed as shown in Fig. 89, which is another species, but serves to show the general arrangement; the underwings are much more transparent and the nerves are very delicate. The colour is grey like the bark of the trees on which they are found; the antennæ which are terminated by two pairs of bristles are composed of ten joints, the eight basal ones yellow striped with black at their upper ends, and the two terminal ones entirely black. The femora are black for the greater part of their length,

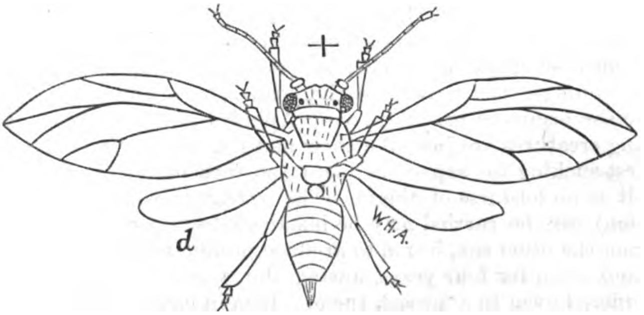

Fig. 89.

as are the tarsi entirely; the tibiæ are yellow. The thorax is black with a white median stripe, and the wing-cases are prettily mottled with brownish dots which form a dark triangular spot, in the middle of each, with the base on the costal margin; there is also a dark spot at the junction of each nerve with tho margin, which has the effect of leaving a more or less distinct sub-terminal white band. The colours vary considerably, but seem to be darker in the females. The abdomen of the male is terminated by several bristle-like appendages, and that of the female by a conical ovipositor. In general appearance, although little more than one line in length, these insects much resemble miniature Cicadæ. I found that many of the galls of this species also were polythalamous, one which I opened containing four pupæ. The occurrence of this insect at Ottawa is somewhat interesting. The three trees of *Celtis occidentalis* upon which the galls occur are the only specimens of that tree which I have found in this locality, during four years of constant botanical investigation. Prof. Macoun, too, tells me that with the exception of a small grove at Belleville these are the only specimens he has heard of east of Toronto. It is evident then that it is quite uncommon, and yet these trees were so thickly covered with galls that the leaves in many instances had more than a dozen galls on their undersides, and had much more the appearance of bunches of berries than of foliage. How did these small insects which only feed on this tree traverse so great a distance from one locality to another? The gall is mammiform, having a thick fleshy outer coat, and inside this a thin woody one; the cavity inhabited by the flat larva is narrow, and the centre of the gall is filled up with a solid mass of the same nature as the outside wall. When the pupæ are mature they work their way up through the top of the galls, which are all on the underside of the leaves, and come out on the upper surface.

The other genus in this division is *Aphis*. These exceedingly injurious insects which attack almost every form of vegetation, are too well known to need any elaborate description. The word *Aphis* is derived from a Greek word meaning to exhaust. Although most of these insects are of small size, very few exceeding one or two lines in length, yet they make up for their want of size by their vast numbers; the rapidity with which they increase is almost beyond credence. "Réaumur has proved that one individual in five generations may become the progenitor of nearly six thousand millions of descendants." (Harris, p. 235).

In the autumn the perfect Aphides pair, and the female lays an egg on the branch of a tree which hatches the next spring. The newly-born larva immediately begins its work of depredation, piercing the young leaves and shoots with its sharp beak. It grows rapidly and soon arrives at maturity. The Rev. J. G. Wood, in "Insects at Home," gives the following concise history of their lives:—"These insects are prolific almost beyond belief. As a general rule, insects lay eggs which are hatched, pass through the state of larva and pupa, and then become perfect insects. But the Plant-lice go on a very different plan. Sometimes as if to show that they are amenable to law, they do lay eggs; but this is the exception and not the rule, which is somewhat as follows, though varied every now and then by these most eccentric of insects: A female Aphis takes her place on a branch —say of the rose—plunges her beak into the tender bark and begins to suck the sap. After a short time she begins to produce young Aphides at an average of fourteen per diem. These young creatures are just like their mother, only less, and immediately follow her example by first sucking the sap of the plant and then producing fresh young. As to the opposite sex it is no business of theirs. The extent to which this peculiar mode of increase (gemmation) can be carried may be imagined from the fact that a single female Aphis, isolated from the other sex, began to produce prolific females, which, in their turn, produced others, and so on for four years, during the whole of which time not a male Aphis had been suffered even to approach them. It is in consequence of this remarkable mode of production that the twigs and buds become so rapidly covered with Aphides, the quickly succeeding generations crawling over the backs of their predecessors so as to arrive at an unoccupied spot of bark in which they can drive their beaks. Thus, at the beginning of a week, say on Monday, a rose-tree may be apparently free from Aphides, or have at the most six or seven of the 'blight' upon it, but by Thursday the whole plant will be so thickly covered with Aphides that scarcely a particle of the bark can be seen."

No part of a plant seems to be exempt from their attacks; driving their sharp beaks through the epidermis, they suck the sap from the leaves, the young twigs, the roots, and even the rough bark of the stem. A good represensation of a too common species, *A. mali*, the apple blight, is given at Fig. 90, and illustrates the structure of most of these insects; we have the winged male of the natural size and the same with the female magnified. The best remedy for all the small insects which affect the bark and foliage of trees, is undoubtedly a frequent application of a solution of whale oil soap thrown on to the foliage by means of a syringe. The bark-lice which swarm on apple-trees in the autumn may be easily cleaned off by means of a thorough scrubbing with soap-suds; the addition of flour of sulphur to this mixture will prevent fungoid diseases making way where the Aphides have injured the bark. Many of the species make galls on different plants as on the poplar. The injuries done by these minute flies, I have said, is very great. Kirby and Spence state that the damage done to hops alone in England often made as much difference as £200,000 in the duty on hops in one year. I have myself occasionally seen in the south of England, what gave promise of being a splendid crop of hops, rendered worthless by a species of Aphis, in the short period of about a fortnight. It is to this family that the dreaded Phylloxera belongs which has absolutely rendered the cultivation of the vine impossible in some parts of France, and I know from personal information that a large grape-grower in one of the best champagne districts in that country had, in 1880, on account of this insect, simply to give up vine-growing, grub up his vineyards, and burn the vines.

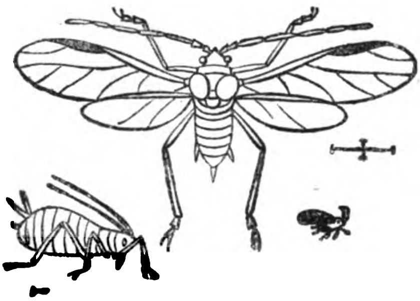
Fig. 90.

Our President has so ably described this insect in its different forms in several papers during the past year or two that further reference to it is unnecessary.

In the last division, Monomera, which have only one joint in the tarsus, we find those extraordinary insects the Coccidæ, or Scale insects, as they are called, on account of the peculiar shape of the females, which in different species take different forms; some are oval and more or less convex, some shaped like a boat turned bottom upwards, some kidney shaped or globular; and one of the best known, the oyster-shell bark louse, takes the shape its name implies. Westwood remarks truly: "These form one of the most anomalous tribes of insects with which we are acquainted, and which already prove that annulose animals may exist, which become more and more imperfect as they approach the winged state, and which in that state lose all trace of articulation in the body as well as of articulated limbs (as in the female Cocci), leaving, in fact, inert and fixed masses of animal matter, motionless and apparently senseless, and which resemble nothing more nearly than the vegetable excrescences called galls."

The females undergo only a partial transformation, and never possess wings; the males on the other hand have a complete metamorphosis, with a quiescent pupal state, in which the rudiments of the antennæ, wings, etc., are perceptible, and have the legs arranged on the breast with the anterior pair directed forwards, a peculiarity not occurring in any other insects. The mature female retains the beak, but does not acquire wings, and the male has two wings, but the mouth parts disappear.

The eggs are hatched beneath the protecting scale, which was formerly the mother's body; they soon make their escape, as active little six-footed grubs, with slender beaks and two long bristles at the end of the body; and in some species, as *C. adonidum*, the Mealy Bug of the greenhouse, are covered with a white powdery covering. Most species, however, are naked. At this stage both sexes are alike.

As soon as they leave the scale they move along the branches towards the tip, and fix their beaks in the bark of the twig. From this time they remain motionless, fastened to the epidermis of the plant by means of small white downy threads emitted from the undersides of their bodies, they lose the caudal bristles, a scale forms over them, and they increase rapidly in size.

In this condition they pass through the winter, and it is not until the following spring that the sexes are developed. Some of the scales will then be noticed to increase in size, and these are the females. Under the smaller scales the transformations of the males take place, and they are remarkably different from those of the females, for in this sex there is what is not found in any other member of this order, a complete metamorphosis. These males remain under the scales (their outer skins) from which they dêtach themselves, until they evolve as perfect insects. After the insects have paired, the body of the female dries up, the whole substance apparently being consumed by the enormous number of eggs she lays. Many of these insects are exceedingly injurious to vegetation, and are difficult to combat. We have several species in Canada, but there is little positive knowledge concerning them. It is a very curious thing how they migrate from one tree to another. They will appear suddenly on trees which have been without them for years. This year, and from the amount of downy material in which it envelops its eggs, a very conspicuous species has appeared for the first time on a Virginian creeper near my house. There were, perhaps, a dozen females this year, and on examining the young shoots a few days ago, I found them well stocked with the half-grown scales. This species seems to answer the description of one Harris mentions on page 256, a thorough investigation of which he was prevented from carrying out by its premature destruction by fire, together with the grape-vine upon which it was feeding.

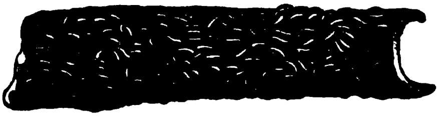
Fig. 91.

The *Aspidiotus conchiformis*, oyster-shell bark louse, attacks many different trees, but chiefly the apple. It has also been found on the currant, plum, pear, cherry, and apricot. Fig. 91 represents a twig of an apple tree covered with these scales. This is becoming a very injurious pest in Ontario, and unluckily gardeners seem to have got an idea that nothing can be done to stop its ravages, so let it take its chance. I have been frequently told that it was useless to apply the soap wash, on account of the insect being protected by a scale. This of course is not the case. If a strong mixture of whale-oil soap, with tobacco in it, is syringed on the trees four times through the month of June, it can be kept well in hand, because then the young larvæ are unprotected by a scale.

Although the greater number of the Coccidæ are so injurious, yet there are some among them which produce commodities of very great commercial value. It is from the female scales of *C. lacca*, a species of this family which attacks *Ficus indica*, that the Indian product lac is obtained. This substance has many uses in the economic arts; it is the chief ingredient in sealing wax and several varnishes, and is also the basis of French polish. In India it is mixed with sand to form grindstones; dissolved in water and mixed with ivory black it makes a good ink. It is also from this insect that the colouring matter called lac-lake is prepared, which has been used as a substitute for cochineal. The East India Company are said to have saved in a few months $70,000 in the purchase of scarlet cloth dyed with a mixture of this colour and cochineal conjointly, and this without any inferiority in the colour obtained. These scales are known as stick-lac when they are unseparated from the twigs upon which they formed; seed-lac when removed and pounded, and a part of their colouring matter extracted in water; lump-lac when melted down into cakes; and shellac when strained and allowed to harden in thin laminæ or flakes. But the most valuable of these insects is, perhaps, the Cochineal (*C. cacti*), which attacks a kind of indigenous cactus (Opuntia cochinillifera) found in Mexico where it is called nopal, and which is cultivated in plantations called nopalleiros, for the express purpose of feeding these insects. It is one of the most remunerative industries of the country. It has been calculated that 70,000 dried insects are required to make a pound of cochineal. In 1866 England imported 32,757cwt., valued at £594,818, and exported 21,238cwt., the annual consumption being about 12,000cwt. The price in 1870 was about 3*s*. a pound. In 1871 the imports into the United States were 1,849,842lb, valued at $1,184,255. Many attempts have been made to introduce this insect into other countries. The East India Company even offered a reward of £6,000 to anyone who would introduce it into India. It was introduced into the Canary Islands about 1830, and after the failure of the grape in 1850, became the principal article of export. In 1870 the exports reached 6,000,000lb, worth on the spot $3,200,000. In 1844 the French succeeded in introducing it into Algeria, and the Dutch have introduced it into Java.

The literature on this family is most meagre, and, in fact, until Prof. Comstock published his article in the United States Department of Agriculture Report of 1880, nothing systematic of any consequence had been done. This gentleman is making a thorough investigation of this difficult but interesting subject, and as it is necessary to have a large series of specimens, it is in the hands of everyone to assist him, for if any person who noticed a plant infested by these insects were to send a note and specimens to him I am sure he would be glad to receive them, and they might possibly do much good by putting into the hands of a specialist, species unknown to science, upon which he would experiment in the same careful and thorough manner which is so manifest in all his work. It is satisfactory to know that after a great number of experiments, Prof. Comstock has found that, for all these insects the most effectual remedy is that very economical one—common soap.

4970
Sept. 1883.

GENERAL INDEX

TO THE

THIRTEEN ANNUAL REPORTS

OF THE

ENTOMOLOGICAL SOCIETY

OF THE

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Prepared for the Honorable the Commissioner of Agriculture by the Society.

COMPILED BY
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LIST OF ILLUSTRATIONS.

The nomenclature of the Reports is retained.

The pagination of the First Report is taken from the Commissioner's Report.

All the other Reports were printed separately from the General Report and their pagination has been followed.

SUMMARY OF ILLUSTRATIONS.

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SUMMARY OF ORDERS ILLUSTRATED.

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	61	104	84	31	46	30	29	58	38	57	74	52	91

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Part II.—CLASSIFIED LIST OF INSECTS ILLUSTRATED.
Part III.—GENERAL INDEX.

PART I.—LIST OF ILLUSTRATIONS.

1870.—REPORT I.

FIG. 1. Apple-root Plant-louse (*Eriomosa* [*Pemphigus*] *pyri*, Fitch); *a*, affected root; *b*, larva; *c*, winged louse.
FIG. 2. Two-striped Borer (*Saperda bivittata*, Say), beetle and larva.
FIG. 3. Buprestis, Apple-tree Borer (*Chrysobothris femorata*, Say), beetle and larva.
FIG. 4. Head of Woodpecker.
FIG. 5. Harris's Bark-louse (*Aspidiotus Harrisii*, Walsh).
FIG. 6. Oyster-shell Bark-louse (*Aspidiotus conchiformis*, Gmélin).
FIG. 7. Oyster-shell Bark-louse (*Aspidiotus conchiformis*, Gmélin). 1, egg (natural size scarcely .01.) 2, larva as it appears when running over the twigs (natural size .01.) 3, its appearance after becoming fixed. 4, appearance of scale after the second plate is formed. 5, form of louse (ventral view) soon after losing its members. 6, form of louse (ventral view) when full-grown and just about to deposit. 7, fully-formed scale, containing louse as it appears from the under side when raised. 8, highly magnified antenna of larva, shewing joints.
FIG. 8. Twice-wounded Lady-bird (*Chilocorus bivulnerus*, Muls.), beetle.
FIG. 9. Twice-wounded Lady-bird (*Chilocorus bivulnerus*, Muls.), larva.
FIG. 10. Apple-tree Pruner (*Stenocorus putator*, Peck: *S. villosus*, Fabr.), beetle.
FIG. 11. Apple-tree Pruner (*Stenocorus putator*, Peck: *S. villosus*, Fabr.), larva.
FIG. 12. Apple-tree Pruner (*Stenocorus putator*, Peck: *S. villosus*, Fabr.), pupa.
FIG. 13. Apple-tree Plant-louse (*Aphis mali*, Fabr.), winged male and wingless female.
FIG. 14. Nine-dotted Lady-bird (*Coccinella novem notata*, Herbst), beetle and larva.
FIG. 15. Lace-wing (*Chrysopa*, Sp.), imago.
FIG. 16. Lace-wing (*Chrysopa*, Sp.), larva and eggs.
FIG. 17. *Syrphus* Fly, larva.
FIG. 18. American Tent-caterpillar (*Clisiocampa Americana*, Harris); *a*, *b*, caterpillars; *c*, eggs; *d*, cocoon.
FIG. 19. Forest Tent-caterpillar (*Clisiocampa sylvatica*, Harris).
FIG. 20. Forest Tent-caterpillar (*Clisiocampa sylvatica*, Harris), male moth and cocoon.
FIG. 21. Forest Tent-caterpillar (*Clisiocampa sylvatica*, Harris), female moth and pupa.
FIG. 22. Green Caterpillar-hunter (*Calosoma scrutator*, Fabr.), beetle.
FIG. 23. White-marked Tussock Moth (*Orgyia leucostigma*, Sm. and Abbott); *a*, wingless female attached to her cocoon; *b*, young larva; *c*, female pupa; *d*, male pupa.
FIG. 24. (*Orgyia leucostigma*, Sm. and Abb.), full-grown larva.
FIG. 25. (*Orgyia leucostigma*, Sm. and Abb.), male moth.
FIG. 26. Yellow-necked Apple-tree Caterpillar (*Datana ministra*, Drury).
FIG. 27. Red-humped Apple-tree Caterpillar (*Notodonta concinna*, Sm. and Abbott); 1, caterpillar; 2, moth.
FIG. 28. Canker-worm (*Anisopteryx vernata*, Peck); *a*, eggs, natural size; *b*, eggs, magnified; *c*, larva; *d*, cocoon; *e*, pupa; *f*, male moth; *g*, wingless female.
FIG. 29. Cecropia Emperor Caterpillar (*Samia* [*Saturnia*] *cecropia*, Linn.).
FIG. 30. Cecropia Emperor Caterpillar (*Samia* [*Saturnia*] *cecropia*, Linn.); cocoon.
FIG. 31. Cecropia Emperor Caterpillar (*Samia* [*Saturnia*] *cecropia*, Linn.); male.
FIG. 32. Codling-worm (*Carpocapsa pomonella*, Linn.); *a*, apple, shewing the work of the larva; *b*, point of entrance of the larva; *d*, pupa; *e*, larva; *f*, *g*, moth; *h*, head of larva; *i*, cocoon.
FIG. 33. Apple Curculio (*Anthonomus quadrigibbus*, Say.); *a*, natural size; *b*, side view; *c*, back view.
FIG. 34. Green Grape-vine Sphinx (*Chœrocampa pampinatrix*, Sm. and Abbott), larva.
FIG. 35. Ichneumon-fly (*Microgaster*, Sp.)
FIG. 36. Ichneumon-fly (*Microgaster*, Sp.); cocoons on *Chœrocampa pampinatrix*.

FIG. 37. Green Grape-vine Sphinx (*Chærocampa pampinatrix*, Sm. and Abb.), chrysalis.
FIG. 38. Green Grape-vine Sphinx (*Chærocampa pampinatrix*, Sm. and Abb.), moth.
FIG. 39. Beautiful Wood-nymph (*Eudryas grata*, Fab.), larva and moth.
FIG. 40. Red-tailed Tachina-fly (*Exorista leucaniæ*, Kirk.).
FIG. 41. Grape-vine Leaf-roller (*Desmia maculalis*, Westwood); 1, caterpillar in folded leaf; 2, enlarged view of head and anterior joints; 3, chrysalis; 4, male moth; 5, female moth.
FIG. 42. Grape-vine Plume (*Pterophorus periscelidactylus*, Fitch); *a*, caterpillars in their retreat; *b*, chrysalis; *c*, one of the dorsal processes of chrysalis; *d*, moth; *e*, one joint of larva enlarged, side view.
FIG. 43. Grape Cidaria (*Cidaria diversilineata*, Hubner), larva and moth.
FIG. 44. Common Yellow Wooly Bear (*Spilosoma virginica*, Fab.); *a*, caterpillar; *b*, chrysalis; *c*, female moth.
FIG. 45. Spotted Pelidnota (*Pelidnota punctata*, Linn.); *a*, larva; *b*, pupa; *c*, beetle; *d*, anal joint of larva; *e*, antenna of larva; *f*, leg of larva.
FIG. 46. Grape-vine Flea-beetle (*Haltica chalybea*, Illiger).
FIG. 47. Grape-vine Flea-beetle (*Haltica chalybea*, Illiger); *a*, larvæ on leaf; *b*, larva enlarged; *c*, earthen cell containing pupa; *d*, beetle.
FIG. 48. (*Isosoma*, Sp.); *a*, female; *b*, male; *c*, antennæ of female; *d*, antennæ of male; *e*, abdomen of female enlarged; *f*, that of male.
FIG. 49. Grape-seed Insect (*Isosoma vitis*, Saunders); *larva* enlarged and natural size.
FIG. 50. Thrips (*Tettigohia vitis*, Harris).
FIG. 51. Grape-leaf Gall-louse (*Pemphigus vitifoliæ*, Fitch), leaf covered with galls.
FIG. 52. Tree-cricket (*Œcanthus niveus*, Harris), male.
FIG. 52. Tree-cricket (*Œcanthus niveus*, Harris), female.
FIG. 53. Plum Curculio (*Conotrachelus nenuphar*, Herbst); *a*, larva; *b*, pupa; *c*, beetle; *d*, fruit attacked.
FIG. 54. Pennsylvania Ground-beetle (*Harpalus pennsylvanicus*, DeGeer).
FIG. 55. Pennsylvania Ground-beetle (*Harpalus pennsylvanicus*, DeGeer), larva.
FIG. 56. Pennsylvania Soldier-beetle (*Chauliognatus pennsylvanicus*, DeGeer); *a*, larva.
FIG. 57. Lace-wing (*Chysopa*, Sp.); *a*, eggs; *b*, larva; *c*, cocoon, the upper figure shewing the lid; *d*, imago.
FIG. 58. Hull Curculio-catcher.
FIG. 59. Hull Curculio-catcher.
FIG. 60. Grey Dagger-moth (*Acronycta psi*, Linn.).
FIG. 61. Eye-spotted Bud-moth (*Grapholitha oculana*), moth and larva.

1871.—REPORT II.

FIG. 1. Oyster Shell Bark-louse (*Aspidiotus conchiformis*, Gmélin).
FIG. 2. Oyster Shell Bark-louse (*Aspidiotus conchiformis*, Gmélin).
FIG. 3. White-marked Tussock Moth (*Orgyia leucostigma*, Smith & Abbott), larva.
FIG. 4. White-marked Tussock Moth (*Orgyia leucostigma*, Smith & Abbott), male moth.
FIG. 5. White-marked Tussock Moth (*Orgyia leucostigma*, Smith & Abbott); *a*, wingless female on cocoon; *b*, young larva suspended by silken thread; *c*, female chrysalis; *d*, male chrysalis.
FIG. 6. Fall Web-worm (*Hyphantria textor*, Harris); *a*, larva; *b*, pupa; *c*, moth.
FIG. 7. The Codling-worm (*Carpocapsa pomonella*, Linn.); representing insect in all its stages and section of an affected apple. [Vide Fig. 32, Report I., 1870.]
FIG. 8. Green Sphinx (*Chærocampa pampinatrix*, Smith & Abbott).
FIG. 9. Green Sphinx (*Chærocampa pampinatrix*, Smith & Abbott), moth.
FIG. 10. Grape-vine Leaf-roller (*Desmia maculalis*, Westwood). [See 1st Report, Fig. 41.]
FIG. 11. Grape-vine Plume-moth (*Pterophorus periscelidactylus*, Fitch). [See 1st Report, Fig. 42.]
FIG. 12. Common Yellow Wooly-bear (*Spilosoma virginica*, Fab.). [See 1st Report, Fig. 44.]
FIG. 13. Spotted Pelidnota (*Pelidnota punctata*, Linn.). [See 1st Report, Fig. 45.]
FIG. 14. Grape-vine Flea-beetle (*Haltica chalybea*, Illiger).
FIG. 15. The Thrip (*Tettigonia vitis*, Harris).

Fig. 16. Grape-leaf Gall-louse (*Pemphigus vitifolia*, Fitch).

Fig. 17. Green Grape-vine Worm (*Amphipyra pyramidoides*, Guen.), larva.

Fig. 18. Green Grape-vine Worm (*Amphipyra pyramidoides*, Guen.), moth.

Fig. 19. The Plum Sphinx-moth (*Sphinx drupiferarum*, Smith & Abbott), larva.

Fig. 20. The Plum Sphinx-moth (*Sphinx drupiferarum*, Smith & Abbott), pupa.

Fig. 21. The Plum Sphinx-moth (*Sphinx drupiferarum*, Smith & Abbott), moth.

Fig. 22. Leaf-cutter Bee (*Megachile brevis*, Say).

Fig. 23. Plum Curculio (*Conotrachelus nenuphar*, Herbst). [See Report I., Fig. 53.]

Fig. 24. Grey Dagger-moth (*Acronycta psi*, Linn.).

Fig. 25. Eye-spotted Bud-moth (*Grapholitha oculana*).

Fig. 26. Imported Gooseberry Saw-fly (*Nematus ventricosus*, Klug); *a*, male; *b*, female.

Fig. 27. Imported Gooseberry Saw-fly (*Nematus ventricosus*, Klug); gooseberry-leaf, shewing eggs (1), and the holes which the young worms make (2, 3).

Fig. 28. Imported Gooseberry Saw-fly (*Nematus ventricosus*, Klug); *a*, *a*, *a*, larvæ; *b*, enlarged view of side shewing tubercles.

Fig. 29. Placid Soldier-bug (*Podiscus placidus*, Uhler); *a*, enlarged; *b*, natural size.

Fig. 30. Native Gooseberry or Currant Saw-fly (*Pristiphora grossulariæ*, Walsh); *a*, larva; *b*, fly.

Fig. 31. Currant Measuring-worm (*Ellopia* (*abraxis*) *ribearia*, Fitch), larvæ.

Fig. 32. Currant Measuring-worm (*Ellopia* (*abraxis*) *ribearia*, Fitch), moth.

Fig. 33. Spinous Currant Caterpillar (*Grapta progne*, Cram.).

Fig. 34. Currant Green Measuring-worm (*Angerona crocaotaria*, Guenee), moth.

Fig. 35. Currant Green Measuring-worm (*Angerona crocaotaria*, Guenee), larva on leaf.

Fig. 36. Currant Black Measuring-worm (*Priocycla armataria*); Herr Sch.).

Fig. 37. Oblique-banded Leaf-roller (*Lozotœnia rosaceana*, Harris), larva and pupa.

Fig. 38. Oblique-banded Leaf-roller (*Lozotœnia rosaceana*, Harris), moth.

Fig. 39. Imported Currant-borer (*Ægeria tipuliformis*, Linn.).

Fig. 40. Gooseberry Fruit-worm (*Pempelia grossulariæ*, Packard).

Fig. 41. Wheat-midge (*Cecidomyia tritici*, Kirby), fly with wings expanded.

Fig. 42. Wheat-midge (*Cecidomyia tritici*, Kirby), fly with wings closed.

Fig. 43. White-midge (*Cecidomyia tritici*, Kirby), eggs of.

Fig. 44. Wheat-midge (*Cecidomyia tritici*, Kirby), wheat-bud injured by.

Fig. 45. Wheat-midge (*Cecidomyta tritici*, Kirby), larva, highly magnified.

Fig. 46. Hessian Fly (*Cecidomyia destructor*, Say).

Fig. 47. Chinch-bug (*Micropus leucopterus*, Say); the figure on the right shews, by way of comparison, another bug, (*Anthocoris insidiosus*, Say).

Fig. 48. Chinch-bug (*Micropus leucopterus*, Say), short-winged form.

Fig. 49. Spotted Ladybird (*Hippodamia maculata* DeGeer).

Fig. 50. Plain Ladybird (*Coccinella munda*, Say).

Fig. 51. Grain-aphis (*Aphis avenæ*, Fabr.).

Fig. 52. Grain-aphis (*Aphis avenæ*, Fabr.), female enlarged.

Fig. 53. Nine-spotted Ladybird (*Coccinella 9-notata*, Herbst), larva and beetle.

Fig. 54. Lace-wing Fly (*Chrysopa* species).

Fig. 55. Lace-wing Fly (*Chrysopa* species), larva and eggs on leaf.

Fig. 56. Syrphus-fly, larva, devouring aphis.

Fig. 57. Syrphus-fly, fly.

Fig. 58. Joint-worm (*Isosoma hordei*, Harris); *a*, the galls carried in the wheat stalk; *b*, the fly

Fig. 59. Joint-worm (*Isosoma hordei*, Harris); *a*, female; *b*, male.

Fig. 60. Joint-worm (*Isosoma hordei*, Harris), larva.

Fig. 61. Army-worm (*Leucania unipuncta*, Haworth), larva.

Fig. 62. Army-worm (*Leucania unipuncta*, Haworth), pupa.

Fig. 63. Army-worm (*Leucania unipuncta*, Haworth), moth.

Fig. 64. Wheat Wire-worm (*Agriotes mancus*, Say), larva and pupa, shewing different parts.

Fig. 65. Three-lined Leaf-beetle (*Lema trilineata*, Oliv.).

Fig. 66. Striped Cucumber-beetle (*Diabrotica vittata*, Fabr.).

Fig. 67. Three-lined Leaf-beetle (*Lema trilineata*, Oliv.), larvæ feeding on potato stalk.

Fig. 68. Colorado Potato-beetle (*Doryphora 10-lineata*, Say); *a*, *a*, eggs; *b*, *b*, *b*, *b*, larva; *c*, pupa; *d*, beetle; *e*, wing-case enlarged; *f*, leg enlarged.
Fig. 69. Ladybird, larva of.
Fig. 70. Spotted Ladybird (*Hippodamia maculata*, DeGeer).
Fig. 71. Nine-spotted Lady-bird (*Coccinella 9-notata*, Herbst).
Fig. 72. Thirteen-spotted Ladybird (*Coccinella 13-punctata*, Linn.).
Fig. 73. Convergent Ladybird (*Hippodamia convergens*, Guen.); *a*, larva; *b*, pupa; *c*, beetle.
Fig. 74. Fifteen-spotted Mysia (*Mysia 15-punctata*, Oliv.).
Fig. 75. Glowing Calosoma (*Calosoma calidum*, Fabr.).
Fig. 76. Murky Ground-beetle (*Harpalus caliginosus*, Say).
Fig. 77. Pennsylvania Ground-beetle (*Harpalus pennsylvanicus*, DeGeer), larva.
Fig. 78. Spined Soldier-bug (*Arma spinosa*, Dallas); *a*, enlarged view of beak.
Fig. 79. Rapacious Soldier-bug (*Reduvius raptatorius*, Say).
Fig. 80. Ring-banded Soldier-bug (*Perillus circumcinctus*, Stal.); *b*, antennæ; *c*, beak enlarged.
Fig. 81. Striped Blister-beetle (*Epicauta vittata*, Fabr.).
Fig. 82. Ash-grey Blister-beetle (*Epicauta Lytta cinerea*, Fabr.); *a*, antennæ; *b*, black-rot blister-beetle (*epicauta murina*, Lec.); *c*, antennæ.
Fig. 83. Potato or Tomato-worm (*Macrosila quinque-maculata*, Hawthorn).
Fig. 84. Rape-butterfly (*Pieris rapæ*, Linn.), male.
Fig. 85. Rape-butterfly (*Pieris rapæ*, Linn.), female.
Fig. 86. Rape-butterfly (*Pieris rapæ*, Linn.); *a*, larva; *b*, pupa.
Fig. 87. Potherb Butterfly (*Pieris oleracea*, Harris; *casta*, Kirby); *a*, larva.
Fig. 88. Potherb Butterfly (*Pieris oleracea*, Harris; *casta*, Kirby), pupa.
Fig. 89. Southern Cabbage-butterfly (*Pieris protodice*, Boisd), male.
Fig. 90. Southern Cabbage-butterfly (*Pieris protodice*, Boisd), female.
Fig. 91. Southern Cabbage-butterfly (*Pieris protodice*, Boisd); *a*, larva; *b*, pupa.
Fig. 92. Zebra-caterpillar (*Mamestra picta*, Harris); *a*, larva; *b*, moth.
Fig. 93. Cabbage Plusia (*Plusia brassicæ*, Riley; *a*, larva; *b*, pupa; *c*, moth.
Fig. 94. Harlequin Cabbage-bug (*Strachia histrionica*, Harris), wings closed.
Fig. 95. Harlequin Cabbage-bug (*Strachia histrionica*, Harris), wings expanded.
Fig. 96. Squash-vine Borer (*Ægeria cucurbitæ*, Harris), larva.
Fig. 97. Squash-vine Borer (*Ægeria cucurbitæ*, Harris), pupa.
Fig. 98. Squash-vine Borer (*Ægeria cucurbitæ*, Harris), moth.
Fig. 99. Squash-bug (*Coreus tristis*, DeGeer).
Fig. 100. Twelve-spotted Diabrotica (*Diabrotica 12-punctata*, Fabr.).
Fig. 101. Striped Cucumber-beetle (*Diabrotica vittata*, Oliv.), larva; *1*, back; *2*, side view.
Fig. 102. Striped Cucumber-beetle (*Diabrotica vittata*, Oliv.), pupa; *1*, front; *2*, back.
Fig. 103. Striped Cucumber-beetle (*Diabrotica vittata*, Oliv.), beetle.
Fig. 104. Cucumber Flea-beetle (*Haltica cucumeris*, Harris).

1872.—REPORT III.

Fig. 1. Rose-beetle (*Macrodactylus subspinosus*, Fabr.).
Fig. 2. Achemon Sphinx (*Philampelus Achemon*, Drury), larva.
Fig. 3. Achemon Sphinx (*Philampelus Achemon*, Drury), pupa.
Fig. 4. Achemon Sphinx (*Philampelus Achemon*, Drury), moth.
Fig. 5. Abbot Sphinx (*Thyreus Abbotii*, Swainson).
Fig. 6. Joint-worm (*Isosoma hordei*, Harris), larva.
Fig. 7. Joint-worm (*Isosoma hordei*, Harris), fly.
Fig. 8. White Grub *Lachnosterna quercina*, Knoch); *1*, pupa; *2*, larva; *3*, *4*, beetle.
Fig. 9. Strawberry Leaf-roller (*Anchylopera fragaria*, Riley); *a*, larva: *b*, anterior part enlarged; *d*, anal segment; *c*, moth.
Fig. 10. Oblique Banded Leaf-roller (*Lozotænia rosaceana*, Harris), larva and pupa.
Fig. 11. Oblique Banded Leaf-roller (*Lozotænia rosaceana*, Harris), moth.
Fig. 12. Currant Green Measuring Worm (*Angerona crocaotaria*, Guen.), moth.

FIG. 13. Smeared Dagger (*Acronycta oblinita*, Sm. & Abb.); *a*, larva; *b*, pupa; *c*, moth.

FIG. 14. Strawberry False-worm (*Emphytus maculatus*, Norton); *1*, *2*, pupa; *3*, *5*, fly; *4*, *6*, larva; *7*, cocoon; *8*, egg enlarged.

FIG. 15. *Osmia Canadensis*, Cresson, enlarged.

FIG. 16. Grain Aphis (*Aphis avenæ*, Fabr.).

FIG. 17. Grain Aphis (*Aphis avenæ*, Fabr.).

FIG. 18. Nine-spotted Ladybird (*Coccinella 9-notata*, Herbst).

FIG. 19. Lace-wing Fly (*Chrysopa*, Sp.).

FIG. 20. Lace-wing Fly, larva.

FIG. 21. Syrphus Fly, larva.

FIG. 22. Syrphus Fly.

FIG. 23. Hop-vine Snout-moth (*Hypena humuli*, Harris).

FIG. 24. Semicolon Butterfly (*Grapta interrogationis*, Godt.).

FIG. 25. Hop-vine Plusia (*Plusia balluca*, Geyer).

FIG. 26. Maple Borer (*Clytus speciosus*, Say).

FIG. 27. Rosy Forest Caterpillar (*Dryocampa rubicunda*, Fabr.).

FIG. 28. American Silk-worm (*Telea Polyphemus*, Linn), female.

FIG. 29. American Silk-worm (*Telea Polyphemus*, Linn.), male.

FIG. 30. American Silk-worm (*Telea Polyphemus*, Linn.), larva.

FIG. 31. American Silk-worm (*Telea Polyphemus*, Linn.), cocoon.

FIG. 32. American Silk-worm (*Telea Polyphemus*, Linn.), pupa.

FIG. 33. Cecropia Emperor Moth (*Platysamia cecropia*, Linn.), larva.

FIG. 34. Peach-borer (*Ægeria exitiosa*, Say); *1*, female; *2*, male.

FIG. 35. Peach-borer (*Ægeria exitiosa*, Say).

FIG. 36. Colorado Potato-beetle (*Doryphora 10-lineata*, Say).

FIG. 37. Fifteen-spotted Mysia (*Mysia 15-punctata*, Oliv.).

FIG. 38. Ring-banded Soldier-bug (*Perillus circumcinctus*, Stal.).

FIG. 39. Archippus Butterfly (*Danais archippus*, Fabr.); *a*, egg enlarged; *c*, natural size; *e*, *f*, lateral and dorsal view of segment of larva; *b*, larva in the act of casting its skin, to shew how the flexible horns are folded (*d*).

FIG. 40. Archippus Butterfly (*Danais archippus*, Fabr.), larva.

FIG. 41. Archippus Butterfly (*Danais archippus*, Fabr.); *a*, *b*, *c*, sucessive stages in changing from caterpillar to chrysalis.

FIG. 42. Archippus Butterfly (*Danais archippus*, Fabr.), pupa.

FIG. 43. Archippus Butterfly (*Danais archippus*, Fabr.), butterfly.

FIG. 44. Disippus Butterfly (*Limenitis disippus*, Godt.), shewing upper surface of left wing, and under surface of right.

FIG. 45. Disippus Butterfly (*Limenitis disippus*, Godt.); *a*, egg enlarged; *e*, natural size.

FIG. 46. Disippus Butterfly (*Limenitis disippus*, Godt.); *a*, larva; *b*, pupa; *c*, hibernaculum; *d*, leaf cut for hibernaculum.

FIG. 47. Hellgrammite Fly (*Corydalus cornutus*, Linn.); *a*, larva; *b*, pupa; *c*, male fly.

FIG. 48. Hellgrammite Fly (*Corydalus cornutus*, Linn.), female.

FIG. 49. Hellgrammite Fly (*Corydalus cornutus*, Linn.), supposed eggs of.

FIG. 50. Murky Ground-beetle (*Harpalus caliginosus*, Say), enlarged figure shewing structure.

FIG. 51. Spined Soldier-bug (*Arma spinosa*, Dallas).

FIG. 52. Plum Sphinx (*Sphinx drupiferarum*, Sm. and Abbott), moth.

FIG. 53. Native Gooseberry Saw-fly (*Pristiphora grossulariæ*, Walsh).

FIG. 54. Ichneumon Fly (*Microgaster*, Sp.).

FIG. 55. Southern Cabbage Butterfly (*Pieris protodice*, Boisd), female.

FIG. 56. Green Grape-vine Sphinx (*Chœrocampa pampinatrix*, Smith), moth.

FIG. 57. Army-worm (*Leucania unipuncta*, Haworth).

FIG. 58. Potherb Butterfly (*Pieris oleracea*, Harris: *casta*, Kirby), pupa.

FIG. 59. Hessian Fly (*Cecidomyia destructor*, Say).

FIG. 60. Red-tailed Tachina, (*Exorista leucaniæ*, Kirk).

FIG. 61. Spotted Pelidnota (*Pelidnota punctata*, Linn.).

Fig. 62. Harlequin Cabbage-bug (*Strachia histrionica*, Harris), open.

Fig. 63. Squash-bug (*Coreus tristis*, DeGeer).

Fig. 64. (*Diplax Elisa*, Hagen).

Fig. 65. Common Tiger-beetle (*Cicindela vulgaris*, Say), larva.

Fig. 66. Common Tiger-beetle (*Cicindela vulgaris*, Say), beetle.

Fig. 67. Purple Tiger-beetle (*Cicindela purpurea*, Oliv.).

Fig. 68. Hairy-necked Tiger-beetle (*Cicindela hirticollis*, Say).

Fig. 69. Handsome Tiger-beetle (*Cicindela generosa*, Dejean).

Fig. 70. Green Caterpillar-hunter (*Calosoma scrutator*, Fabr.).

Fig. 71. Glowing Calosoma (*Calosoma calidum*, Fabr.).

Fig. 72. Murky Ground-beetle (*Harpalus caliginosus*, Say).

Fig. 73. Pennsylvania Ground-beetle (*Harpalus pensylvanicus*, DeGeer).

Fig. 74. Pennsylvania Ground-beetle (*Harpalus pensylvanicus*, DeGeer), larva.

Fig. 75. Bombardier-beetle (*Brachinus fumans*, Linn.).

Fig. 76. Buprestis Apple-tree Borer (*Chrysobothris femorata*, Fabr.).

Fig. 77. Striped Blister-beetle (*Epicauta vittata*, Fabr.).

Fig. 78. Plum-curculio (*Conotrachelus nenuphar*, Herbst).

Fig. 79. Apple-tree Borer (*Stenocorus putator*).

Fig. 80. Cucumber-beetle (*Diabrotica vittata*, Fabr.)

Fig. 81. Twice-wounded Ladybird (*Chilocorus bivulnerus*, Muls.).

Fig. 82. Spotted Ladybird (*Hippodamia maculata*, DeGeer).

Fig. 83. Nine-dotted Ladybird (*Coccinella 9-notata*, Herbst).

Fig. 84. Convergent Ladybird (*Hippodamia convergens*, Guen.).

1873.—REPORT IV.

Fig. 1. Raspberry-root Gall-fly (*Rhodites radicum*, Osten Sacken.)

Fig. 2. Red-necked Agrilus (*Agrilus ruficollis*, Fabr.); raspberry-cane affected.

Fig. 3. Red-necked Agrilus (*Agrilus ruficollis*, Fabr.); larva.

Fig. 4. Red-necked Agrilus (*Agrilus ruficollis*, Fabr.); *c*, beetle.

Fig. 5. Tree-cricket (*Œcanthus niveus*, Say), male.

Fig. 6. Tree-cricket (*Œcanthus niveus*, Say), female.

Fig. 7. Fall Web-worm (*Hyphantria textor*, Harris.)

Fig. 8. Oblique-banded Leaf-roller (*Lozotænia rosaceana*, Harris), larva and pupa.

Fig. 9. Oblique-banded Leaf-roller (*Lozotænia rosaceana*, Harris), moth.

Fig. 10. Raspberry Geometer (*Aplodes rubivora*, Riley); *a*, raspberry, with larva; *b*, segment of skin of larva; *c*, moth; *d*, wings enlarged.

Fig. 11. Flea-like Negro-bug (*Corimelæna pulicaria*, Germ.).

Fig. 12. Strawberry False-worm (*Emphytus maculatus*, Norton).

Fig. 13. Tiger Swallow-tail Butterfly (*Papilio turnus*, Linn.).

Fig. 14. Tiger Swallow-tail Butterfly (*Papilio turnus*, Linn.), larva.

Fig. 15. Isabella Tiger-moth (*Pyrrharctia* [*Spilosoma*] *Isabella*, Sm.); *a*, larva; *b*, pupa; *c*, moth.

Fig. 16. (*Arctia Saundersii*, Grote).

Fig. 17. Gigantic Water-bug (*Belostoma grandis*, Linn.).

Fig. 18. Many-lined Iulus (*Iulus multistriatus*, Walsh).

Fig. 19. Bacon Beetle (*Dermestes lardarius*, Linn.); *a*, larva; *b*, one of its barbed hairs.

Fig. 20. Clothes-moth (*Tinea flavifrontella*, Linn.), moth.

Fig. 21. Clothes-moth (*Tinea flavifrontella*; Linn.), larva and case.

Fig. 22. Mosquito (*Culex pipiens ?* Linn.).

Fig. 23. Head of Mosquito, magnified.

Fig. 24. Tongue of House-fly (*Musca domestica*).

Fig. 25. Horse Breeze-fly (*Œstrus* [*gasterophilus*] *equi*, Fabr.), male.

Fig. 26. Horse Breeze-fly (*Œstrus* [*gasterophilus*] *equi*, Fabr.), female.

Fig. 27. Horse Breeze-fly (*Œstrus* [*gasterophilus*] *equi*, Fabr.), eggs on horse-hair.

FIG. 28. Horse Breeze-fly (*Œstrus [gasterophilus] equi*, Fabr.), larvæ adhering to stomach of horse.
FIG. 29. Ox Bot-fly (*Œstrus bovis*, Fabr.).
FIG. 30. Ox Bot-fly (*Œstrus bovis*, Fabr.), fly emerging from pupa ; ovipositor of female.
FIG. 31. Sheep Bot-fly (*Œstrus ovis*, Linn.).

1874.—REPORT V.

FIG. 1. Io Moth (*Saturnia [hyperchiria] Io*, Fabr.), larva.
FIG. 2. Io Moth (*Saturnia [hyperchiria] Io*, Fabr.), spines of larva.
FIG. 3. Io Moth (*Saturnia [hyperchiria] Io*, Fabr.), male.
FIG. 4. Io Moth (*Saturnia [hyperchiria] Io*, Fabr.), female.
FIG. 5. Flat-headed Apple-tree Borer (*Chrysobothris femorata*, Fabr.).
FIG. 6. Flat-headed Apple-tree Borer (*Chrysobothris femorata*, Fabr.), larva.
FIG. 7. Currant-worm (*Nematus ventricosus*, Klug.); leaf with eggs.
FIG. 8. Currant-worm (*Nematus ventricosus*, Klug.), larva.
FIG. 9. Currant-worm (*Nematus ventricosus*, Klug.), fly.
FIG. 10. Larva and eggs of Lace-wing fly (*Chrysopa*, Sp.).
FIG. 11. Lace-wing Fly (*Chrysopa*, Sp.).
FIG. 12. Currant Measuring-worm (*Ellopia [abraxis] ribearia*, Fitch).
FIG. 13. Currant Measuring-worm (*Ellopia [abraxis] ribearia*, Fitch).
FIG. 14. White-marked Tussock-moth (*Orgyia leucostigma*, Sm. and Abb.), larva.
FIG. 15. White-marked Tussock-moth (*Orgyia leucostigma*, Sm. and Abb.), moth, male.
FIG. 16. White-marked Tussock-moth (*Orgyia leucostigma*, Sm. and Abb.), female moth, pupa.
FIG. 17. Cecropia Moth (*Attacus cecropia*, Linn.), female.
FIG. 18. Cecropia Moth (*Attacus cecropia*, Linn.), cocoon.
FIG. 19. Cecropia Moth (*Attacus cecropia*, Linn.), larva.
FIG. 20. Long-tailed Ophion (*Ophion macrurum*, Linn.).
FIG. 21. Long-tailed Ophion (*Ophion macrurum*, Linn.).
FIG. 22. Yellow-tailed Tachina-fly (*Exorista flavicauda*, Riley).
FIG. 23. Cecropia Chalcis-fly (*Chalcis mariæ*, Riley).
FIG. 24. Divorced Cryptus (*Cryptus nuncius*, Say : *extrematis*, Cresson), cocoon.
FIG. 25. Clouded-sulphur Butterfly (*Colias philodice*, Godt.), male.
FIG. 26. Clouded-sulphur Butterfly (*Colias philodice*, Godt.), female.
FIG. 27. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.).
FIG. 28. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.), larva, common variety.
FIG. 29. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.), larva, black variety.
FIG. 30. 17-year Locust (*Cicada septemdecim*, Linn.) ; *a*, pupa ; *b*, empty pupa case ; *c*, perfect insect ; *d*, perforations in twig for deposit of eggs ; *e*, egg.
FIG. 31. Rocky Mountain Locust (*Caloptenus spretus*, Thomas).
FIG. 32. Katydid (*Cyrtophyllum concavum*, Say).
FIG. 33. Red-legged Locust (*Caloptenus femur-rubrum*, Burm.).
FIG. 34. Hateful Locust (*Caloptenus spretus*, Uhler).
FIG. 36. Wier's Shingle Locust-trap, shut.
FIG. 37. Wier's Shingle Locust-trap, open.
FIG. 38. Ring-legged Pimpla (*Pimpla annulipes*, Br.), female.
FIG. 39. Delicate Long-sting (*Macrocentrus delicatus*, Cress.), female.
FIG. 40. Pear-tree Slug (*Selandria cerasi*, Peck).
FIG. 41. Pear-tree Slug (*Selandria cerasi*, Peck), larvæ ; *a*, enlarged.
FIG. 42. Grape-vine Phylloxera (*Phylloxera vastatrix*, Planchon) : Type *Gallæcola* or Gall-inhabiting ; leaf with Galls.
FIG. 43. Grape-vine Phylloxera (*Phylloxera vastatrix*, Planchon) : Type *Gallæcola*, different stages.
FIG. 44. Grape-vine Phylloxera (*Phylloxera vastatrix*, Planchon) : Type *Radicola*, or Root-inhabiting ; different stages.
FIG. 45. Grape-vine Phylloxera (*Phylloxera vastatrix*, Planchon) : Type *Radicola*, enlarged.
. 46. Phylloxera Mite (*Tyroglyphus phylloxera*, Planchon and Riley), dorsal and ventral view.

1875.—REPORT VI.

Fig. 1. Spring Canker-worm (*Anisopteryx vernata*, Peck); *a*, larva; *b*, eggs, one enlarged; *c*, side-view enlarged, of one joint of larva; *d*, dorsal view of same.
Fig. 2. Spring Canker-worm (*Anisopteryx vernata*, Peck); *a*, male moth: *b*, female, natural size; *c*, part of antenna of female; *d*, segment of female abdomen; *e*, ovipositor, enlarged.
Fig. 3. Fall Canker-worm (*Anisopteryx pometaria*, Harris); *a*, *b*, egg enlarged, side and top views; *c*, *d*, joint of larva, enlarged, side and dorsal view; *e*, eggs, natural size; *f*, caterpillar; *g*, female chrysalis; *h*, tip of chrysalis, enlarged.
Fig. 4. Fall Canker-worm (*Anisopteryx pometaria*, Harris); *a*, male moth; *b*, female, natural size; *c*, joints of female antenna; *d*, one joint of female abdomen, enlarged.
Fig. 5. Glowing Calosoma (*Calosoma calidum*, Fabr.).
Fig. 6. Green Caterpillar-hunter (*Calosoma scrutator*, Fabr.).
Fig. 7. Tent-caterpillar (*Clisiocampa Americana*, Harris); *a*, *b*, larvæ; *c*, eggs; *d*, pupa.
Fig. 8. Forest Tent-caterpillar (*Clisiocampa sylvatica*, Harris); larva.
Fig. 9. English Cabbage-butterfly (*Pieris rapæ*, Linn.), male.
Fig. 10. English Cabbage-butterfly (*Pieris rapæ*, Linn.), female.
Fig. 11. English Cabbage-butterfly (*Pieris rapæ*, Linn.); *a*, larva; *b*, pupa.
Fig. 12. Pear-tree Slug (*Selandria cerasi*, Peck).
Fig. 13. Pear-tree Slug (*Selandria cerasi*, Peck), larva.
Fig. 14. Gooseberry-worm (*Nematus ventricosus*, Klug.).
Fig. 15. Currant Measuring-worm (*Ellopia* [*abraxis*] *ribearia*, Fitch).
Fig. 16. Colorado Potato-beetle (*Doryphora decemlineata*, Say).
Fig. 17. Beautiful Deiopeia (*Deiopeia bella*, Drury.)
Fig. 18. Clover Drasteria (*Drasteria erecthea*, Cram.)
Fig. 19. Beautiful Wood-nymph (*Eudryas grata*, Fabr.).
Fig. 20. Beautiful Wood-nymph (*Eudryas grata*, Fabr.), larva.
Fig. 21. Red-tailed Tachina-fly (*Exorista leucaniæ*).
Fig. 22. Cylindrical Orthosoma (*Orthosoma cylindricum*, Fabr.).
Fig. 23. Cylindrical Orthosoma (*Orthosoma cylindricum*, Fabr.), larva.
Fig. 24. American Silk-worm (*Telea polyphemus*), male.
Fig. 25. American Silk-worm (*Telea polyphemus*), female.
Fig. 26. American Silk-worm (*Telea polyphemus*), larva.
Fig. 27. American Silk-worm (*Telea polyphemus*), cocoon.
Fig. 28. American Silk-worm (*Telea polyphemus*), pupa.
Fig. 29. Long-tailed Ophion (*Ophion macrurum*, Linn.).
Fig. 30. Rocky Mountain Locust (*Caloptenus spretus*, Thomas).

1876.—REPORT VII.

Plate.
Fig. 1. (*Meloe angusticollis*, Say).
Fig. 2. (*Cysteodemus armatus*, Lec).
Fig. 3. Chinese Blister-beetle (*Mylabris cichorii*, Linn.).
Fig. 4. (*Macrobasis albida*, Say).
Fig. 5. (*Macrobasis atrivittata*, Lec).
Fig. 6. (*Macrobasis segmentata*, Say).
Fig. 7. Striped Blister-beetle (*Epicauta vittata*, Fab.).
Fig. 8. Ash-gray Blister-beetle (*Epicauta cinerea*, Forst.).
Fig. 9. Spanish Blister-beetle (*Cantharis vesicatoria*, Lec).
Fig. 10. Spanish Blister-beetle (*Cantharis vulnerata*, Lec).
Fig. 11. Spanish Blister-beetle (*Cantharis nutalli*, Say).
Fig. 12. (*Pyrota mylabrina*, Cher.),
Fig. 13. (*Tegrodera erosa*, Lec).

WOOD-CUTS.

FIG. 1. Larva of Meloe-beetle.
FIG. 2. Red-legged Locust (*Caloptenus femur-rubrum*, Brown).
FIG. 3. Luna Moth (*Actias luna*, Linn.).
FIG. 4. (*Deilephila chamænerii*, Harris).
FIG. 5. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.).
FIG. 6. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.), larva.
FIG. 7. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.), larva, black variety.
FIG. 8. Black Swallow-tail Butterfly (*Papilio asterias*, Cramer).
FIG. 9. Gooseberry Fruit-worm (*Pempelia grossulariæ*, Packard).
FIG. 10. Bee-moth (*Gallerea cereana*, Fabr.); *a*, larva; *b*, cocoon; *c*, pupa; *d*, *e*, moth.
FIG. 11. Bee-killer (*Trupanea apivora*, Fitch).
FIG. 12. Ring-legged Pimpla (*Pimpla annulipes*, Br.).
FIG. 13. Delicate Long-sting (*Macrocentrus delicatus*, Cresson).
FIG. 14. Sigalphus Curculio-parasite (*Sigalphus curculionis*, Fitch); *a*, larva; *b*, cocoon; *c*, pupa.
FIG. 15. Sigalphus Curculio-parasite (*Sigalphus curculionis*, Fitch); *a*, male; *b*, female; *c*, antenna.
FIG. 16. Porizon Curculio-parasite (*Porizon conotracheli*, Riley); *a*, male; *b*, female; *c*, antenna.

1877.—REPORT VIII.

PLATE.

FIG. 1. (*Monohammus scutellatus*, Say).
FIG. 2. Maple-tree Borer (*Clytus speciosus*, Say).
FIG. 3. Cylindrical Orthosoma (*Orthosoma cylindricum*, Fabr.).
FIG. 4. Locust-tree Borer (*Clytus robiniæ*, Forst.).
FIG. 5. Buprestis Apple-tree Borer (*Chrysobothris femorata*, Fabr.).
FIG. 6. White-lined Apple-tree Borer (*Saperda candida*, Fabr.).
FIG. 7. (*Monohammus confusor*, Kirby).
FIG. 8. Raspberry Twig-girdler (*Oberea tripunctata*, Fab.).

WOOD-CUTS.

FIG. 1. Cylindrical Orthosoma (*Orthosoma cylindricum*, Fabr.), larva.
FIG. 2. Buprestis Apple-tree Borer (*Chrysobothris femorata*, Fabr.).
FIG. 3. Two-striped Apple-tree Borer (*Saperda candida*, Fabr.).
FIG. 4. Apple Aphis (*Aphis mali*, Fabr.).
FIG. 5. Apple Aphis (*Aphis mali*, Fabr.), larva enlarged.
FIG. 6. Apple-root Plant-louse (*Eriosoma pyri*, Fitch).
FIG. 7. Root-louse Syrphus-fly (*Pipiza radicans*, Walsh and Riley)
FIG. 8. Nine-spotted Ladybird (*Coccinella 9-notata*, Herbst).
FIG. 9. Larva of Ladybird.
FIG. 10. Spotted Ladybird (*Hippodamia maculata*, DeGeer).
FIG. 11. Thirteen-spotted Ladybird (*Hippodamia 13-punctata*, Linn.).
FIG. 12. Trim Ladybird (*Coccinella munda*, Say).
FIG. 13. Convergent Ladybird (*Hippodamia convergens*, Guen.).
FIG. 14. Fifteen-spotted Mysia (*Mysia 15-punctata*, Oliv.).
FIG. 15. Twice-stabbed Ladybird (*Chilocorus bivulnerus*, Muls.).
FIG. 16. Twice-stabbed Ladybird (*Chilocorus bivulnerus*, Muls.), larva.
FIG. 17. *Chrysopa* species.
FIG. 18. *Chrysopa* species, larva and eggs.
FIG. 19. *Syrphus*-fly species.
FIG. 20. *Syrphus*-fly species, larva.
FIG. 21. Tent-caterpillar (*Clisiocampa Americana*, Harris), larva.
FIG. 22. Tent-caterpillar (*Clisiocampa Americana*, Harris), moth, male.
FIG. 23. Tent-caterpillar (*Clisiocampa Americana*, Harris), moth, female.
FIG. 24. Tent-caterpillar of the Forest (*Clisiocampa sylvatica*, Harris), larva.

WOOD-CUTS—*Continued.*
FIG. 25. Currant-bush Borer, (*Ægeria tipuliformis*, Linn.).
FIG. 26. Currant-worm (*Nematus ventricosus*, Klug), larva.
FIG. 27. Currant-worm (*Nematus ventricosus*, Klug), fly.
FIG. 28. Currant-worm (*Nematus ventricosus*, Klug), leaf with larva.
FIG. 29. Gooseberry Fruit-worm (*Pempelia grossulariæ*, Packard).
FIG. 30. May-beetle (*Phyllophaga quercina*, Knoch).
FIG. 31. Spotted-Pelidnota (*Pelidnota punctata*, Linn.).
FIG. 32. Grape-vine Flea-beetle (*Haltica chalybea*, Illiger).
FIG. 33. Grape-vine Flea-beetle (*Haltica chalybea*, Illiger), beetle.
FIG. 34. Codling-moth (*Carpocapsa pomonella*, Linn.).
FIG. 35. Plum-curculio (*Conotrachelus nenuphar*, Herbst.).
FIG. 36. Isabella Tiger-moth (*Arctia Isabella*, Sm.).
FIG. 37. Willow Gall-fly (*Cecidomyia strobiloides*, O. S.).
FIG. 38. Grape-vine Apple-gall (*Vitis-pomum*, Walsh and Riley).
FIG. 39. Grape-vine Filbert-gall (*Vitis-coryloides*, W. and R.).
FIG. 40. Grape-vine Tomato-gall (*Vitis-tomatos*, O. S.).
FIG. 41. Grape-leaf Trumpet-gall (*Vitis-viticola*, O. S.).
FIG. 42. Three-spotted Dragon-fly (*Libellula trimaculata*, DeGeer)
FIG. 43. Dragon-fly, in different stages.
FIG. 44. Four-spotted Dragon-fly (*Libellula quadrimaculata*, Linn.).
FIG. 45. (*Diplax berenice*, Drury), male.
FIG. 46. (*Diplax berenice*, Drury), female.
FIG. 47. Larva of *Diplax*.
FIG. 48. (*Nanniphyia bella*, Uhler).
FIG. 49. (*Agrion Saucium.*, Brown).
FIG. 50. Hessian-fly (*Cecidomyia destructor*, Say).

1878.—REPORT IX.

FIG. 1. Bacon-beetle (*Dermestes lardarius*, Linn.).
FIG. 2. Tulip-tree Bark-louse (*Lecanium tulipiferæ*).
FIG. 3. Beating-net.
FIG. 4. Beating-net.
FIG. 5. Forest Tent-caterpillar (*Clisiocampa sylvatica*, Harris), larva.
FIG. 6. Forest Tent-caterpillar (*Clisiocampa sylvatica*, Harris); *a*, egg cluster; *c*, upper surface of egg; *d*, arrangement of eggs.
FIG. 7. Striped Cucumber-beetle (*Diabrotica vittata*, Fabr.)
FIG. 8. Striped Cucumber-beetle (*Diabrotica vittata*, Fabr.), larva.
FIG. 9. Striped Cucumber-beetle (*Diabrotica vittata*, Fabr.), pupa.
FIG. 10. Squash-bug (*Coreus tristis*, DeGeer).
FIG. 11. Oyster-shell Bark-louse (*Aspidiotus conchiformis*, Gmélin).
FIG. 12. Oyster-shell Bark-louse (*Aspidiotus conchiformis*, Gmélin).
FIG. 13. Maple-tree Borer (*Clytus speciosus*, Say).
FIG. 14. Carpet-beetle (*Anthrenus scrophulariæ*); *a*, larva; *b*, skin of larva; *c*, pupa; *d*, beetle.
FIG. 15. Lace-wing Fly (*Chrysopa*, Sp.)
FIG. 16. Common Tiger-beetle (*Cicindela vulgaris*, Say).
FIG. 17. Purple Tiger-beetle (*Cicindela purpurea*, Riv.)
FIG. 18. Hairy-necked Tiger-beetle (*Cicindela hirticollis*, Say).
FIG. 19. Six-spotted Tiger-beetle (*Cicindela sex-guttata*, Fabr.).
FIG. 20. Handsome Tiger-beetle (*Cicindela generosa*, Dej.).
FIG. 21. Larva of Tiger-beetle.
FIG. 22. Glowing Calosoma (*Calosoma calidum*, Fabr.).
FIG. 23. Green Caterpillar-hunter (*Calosoma scrutator*, Fabr.).

Fig. 24. Murky Ground-beetle (*Harpalus caliginosus*, Say)
Fig. 25. Pennsylvania Ground-beetle (*Harpalus pensylvanicus*, DeGeer).
Fig. 26. Pennsylvania Ground-beetle (*Harpalus pensylvanicus*, DeGeer), larva.
Fig. 27. Bombardier-beetle (*Brachinus fumans*, Linn.).
Fig. 28. Nine-spotted Ladybird (*Coccinella novem-notata*, Herbst).
Fig. 29. Plain Ladybird (*Coccinella munda*, Say).
Fig. 30. Spotted Ladybird (*Hippodamia maculata*, DeGeer).
Fig. 31. Thirteen-dotted Ladybird (*Hippodamia 13-punctata*, Linn.).
Fig. 32. Convergent Ladybird (*Hippodamia convergens*, Guen.).
Fig. 33. 15-spotted Mysia (*Mysia 15-punctata*, Oliv.).
Fig. 34. The Twice-stabbed Ladybird (*Chilocorus bivulnerus*, Muls.).
Fig. 35. Larva of Ladybird.
Fig. 36. *Buprestis.*
Fig. 37. Red-necked Agrilus (*Agrilus ruficollis*, Fabr.).
Fig. 38. *Papilio Cresphontes*, Cram.)

1879.—REPORT X.

Fig. 1. Carpet-bug (*Anthrenus scrophulariæ*, Linn.).
Fig. 2. Glassy Cut-worm (*Agrotis devastator*, Brace).
Fig. 3. Greasy Cut-worm (*Agrotis telifera*, Harris).
Fig. 4. Western striped Cut-worm (*Agrotis subgothica*, Haworth).
Fig. 5. Dark-sided Cut-worm (*Agrotis cochranii*, Riley : var. *A. messoria*, Harris ?).
Fig. 6. W-marked Cut-worm (*Agrotis clandestina*, Harris).
Fig. 7. Common round-web Spider (*Epeira vulgaris*, Hentz) ; enlarged, under side.
Fig. 8. Common round-web Spider (*Epeira vulgaris*, Hentz) ; enlarged, claws on terminal joints of legs.
Fig. 9. Claw of Jumping Spider (*Salticus*, Sp.).
Fig. 10. Common round-web Spider (*Epeira vulgaris*, Hentz) ; enlarged, upper side.
Fig. 11. Arrangement of internal organs of a spider, enlarged.
Fig. 12. *Mygale Hentzii*, enlarged.
Fig. 13. *Drassus*, Sp., enlarged.
Fig. 14. Common Grass-spider (*Agalena nævia*), enlarged.
Fig. 15. Wolf-spider (*Lycosa*, Sp.), enlarged.
Fig. 16. Grey Jumping-spider (*Salticus*, Sp.), enlarged.
Fig. 17. Crab-spider (*Thomisus*, Sp.).
Fig. 18. House-spider (*Theridion*, Sp.).
Fig. 19. Biting apparatus of spider (*Epeira vulgaris*, Hentz).
Fig. 20. Biting apparatus of spider (*Epeira vulgaris*, Hentz), claw enlarged.
Fig. 21. Spinning apparatus (*Epeira vulgaris*, Hentz), enlarged.
Fig. 22. Nest of spider (*Dolomedes*, Sp.).
Fig. 23. Cobwebs.
Fig. 24. Geometrical webs.
Fig. 25. Flying-spiders.
Fig. 26. Flying-spiders.
Fig. 27. Trap-door-spiders—A, nest of *atypus* ; B, nest with thick door ; C, nest with thin door ; D, branched nest ; E, nest with two doors ; F, branched nest with two doors ; G, nest with two branches.
Fig. 28. Cocoons of spiders (*Epeira strix*).
Fig. 29. Cocoons of spiders (*Theridion*, Sp.).
Fig. 30. Cocoons of spiders (*Argiope*, Sp.).
Fig. 31. Pea-weevil (*Bruchus pisi*, Linn.), *a*, beetle ; *b*, larva ; *c*, pea infected.
Fig. 32. Stag-beetle (*Lucanus dama*, Fabr.).
Fig. 33. May-beetle (*Lachnosterna quercina*, Knoch).
Fig. 34. Rose-bug (*Macrodactylus subspinosus*, Fabr.).

Fig. 35. Spotted Pelidnota (*Pelidnota punctata*, Linn.).
Fig. 36. Goldsmith-beetle (*Cotalpa lanigera*, Linn.).
Fig. 37. Flower-beetle (*Euryomia Inda*, Linn.).
Fig. 38. Water-tiger (*Dytiscus Harrisii*).
Fig. 39. Water-beetle (*Hydrophilus triangularis*).
Fig. 40. Tiger Swallowtail (*Papilio turnus*, Linn.).
Fig. 41. Tiger Swallowtail (*Papilio turnus*, Linn.), larva.
Fig. 42. Achemon Sphinx (*Philampelus achemon*, Drury).
Fig. 43. Achemon Sphinx (*Philampelus achemon*, Drury), larva.
Fig. 44. Achemon Sphinx (*Philampelus achemon*, Drury), pupa.
Fig. 45. (*Catocala ultronia*, Herbst).
Fig. 46. Io-moth (*Saturnia Io*, Fabr.), larva.
Fig. 47. Io-moth (*Saturnia Io*, Fabr.); moth, male.
Fig. 48. Io-moth (*Saturnia Io*, Fabr.); moth, female.
Fig. 49. American Currant-borer (*Psenocerus supernotatus*, Say).
Fig. 50. Imported Currant-borer (*Ægeria tipuliformis*, Linn.).
Fig. 51. West Indian Fire-fly (*Pyrophorus noctilucus*).
Fig. 52. Eyed Spring-beetle (*Alaus occulatus*, Linn.).
Fig. 53. Wheat Wire-worm (*Agriotes mancus*, Say), larva.
Fig. 54. Wheat Wire-worm (*Agriotes mancus*, Say), pupa.
Fig. 55. Plum Curculio (*Conotrachelus nenuphar*, Herbst).
Fig. 56. Sigalphus Curculio Parasite (*Sigalphus curculionis*, Fitch).
Fig. 57. Porizon Curculio Parasite (*Porizon conotracheli*, Riley).

1880.—REPORT XI.

Fig. 1. Glowing Calosoma (*Calosoma calidum*, Fabr.).
Fig. 2. Green Caterpillar-hunter (*Calosoma scrutator*, Fabr.).
Fig. 3. Woolly-bear (*Spilosoma virginica*, Fabr.).
Fig. 4. Common Tiger-beetle (*Cicindela vulgaris*, Say).
Fig. 5. Purple Tiger-beetle (*Cicindela purpurea*, Riv.).
Fig. 6. Six-spotted Tiger-beetle (*Cicindela sexguttata*, Fabr.).
Fig. 7. Hairy-necked Tiger-beetle (*Cicindela hirticollis*, Say).
Fig. 8. Handsome Tiger-beetle (*Cicindela generosa*, Dej.).
Fig. 9. Larva of Tiger-beetle (*Cicindela*, Sp.).
Fig. 10. Tomato-worm (*Sphinx quinque-maculata*, Haworth).
Fig. 11. Canadian Locust (*Caloptenus femur-rubrum*, Burm.).
Fig. 12. Archippus Butterfly (*Danais Archippus*, Fabr.).
Fig. 13. Maple-tree Borer (*Clytus speciosus*, Say).
Fig. 14. Archippus Butterfly (*Danais Archippus*, Fabr.).
Fig. 15. (*Libythea Bachmani*).
Fig. 16. (*Papilio philenor*).
Fig. 17. (*Papilio philenor*), larva.
Fig. 18. (*Papilio philenor*), pupa.
Fig. 19. (*Papilio cresphontes*, Cramer).
Fig. 20. Abbot Sphinx (*Thyreus Abbotii*, Swainson).
Fig. 21. Turnip Flea-beetle (*Haltica nemorum*, Linn.).
Fig. 22. Onion-fly (*Anthomyia ceparum*).
Fig. 23. Cabbage-butterfly (*Pieris rapæ*, Linn.).
Fig. 24. Cabbage-butterfly (*Pieris rapæ*, Linn.).
Fig. 25. Eyed Elater (*Alaus occulatus*, Linn.).
Fig. 26. Wheat-midge (*Cecidomyia tritici*).
Fig. 27. Wheat Aphis (*Aphis granaria*).

FIG. 28. Pear-tree Slug (*Selandria cerasi*, Peck).
FIG. 29. Gooseberry Saw-fly (*Nematus ribesii*).
FIG. 30. Asparagus Beetle (*Criocerus asparagi*, Linn.).
FIG. 31. Apple Curculio (*Anthonomus quadrigibbus*, Say).
FIG. 32. Pea Weevil (*Bruchus pisi*, Linn.).
FIG. 33. Bean Weevil (*Bruchus fabæ*, Riley).
FIG. 34. Rose bug (*Macrodaclylus subspinosus*, Fabr.).
FIG. 35. White-pine Weevil (*Pissodes strobi*, Peck).
FIG. 36. Plum Curculio (*Conotrachelus nenuphar*, Herbst).
FIG. 37. Plum Gouger (*Anthonomus prunicida*, Walsh).
FIG. 38. Strawberry Crown-borer (*Tyloderma fragariæ*).
FIG. 39. Sigalphus Curculio Parasite (*Sigalphus curculionis*, Fitch).
FIG. 40. Quince Curculio (*Conotrachelus cratægi*).
FIG. 41. Imbricated Snout-beetle (*Epicærus imbricatus*).
FIG. 42. Corn Snout-beetle (*Sphenophorus zeæ*).
FIG. 43. Potato-stalk Weevil (*Baridius trinotatus*).
FIG. 44. Blue Digger-wasp (*Chlorion cyaneum*, Dahlb.).
FIG. 45. Tiger Swallow-tail (*Papilio turnus*, Linn.).
FIG. 46. Red-tailed Tachina-fly (*Exorista leucaniæ*), Kirk).
FIG. 47. Cylindrical Orthosoma (*Orthosoma cylindricum*).
FIG. 48. Giant Water-bug (*Belostoma grandis*, Linn.).
FIG. 49. Rocky Mountain Locust (*Caloptenus spretus*, Uhler).
FIG. 50. Three-spotted Dragon-fly (*Libellula trimaculata*, DeGeer).
FIG. 51. Delicate Long-sting (*Macrocentrus delicatus*, Cress).
FIG. 52. Army Worm (*Leucania unipuncta*, Haworth), larva.
FIG. 53. Army Worm (*Leucania unipuncta*, Haworth), moth.
FIG. 54. Gooseberry Saw-fly (*Nematus ventricosus*, Klug), eggs of fly.
FIG. 55. Red Spider (*Tetranychus telarius*), male.
FIG. 56. Harvest Bug (*Tetranychus autumnalis*).
FIG. 57. Harvest Mite (*Trombidium irritans*).
FIG. 58. House-fly Parasite (*Trombidium parasiticum*).
FIG. 59. Grasshopper Parasite (*Trobidium gryllarium*).
FIG. 60. Grasshopper Parasite (*Trombidium sericeum*).
FIG. 61. Bird Tick (*Dermanyssus avium*).
FIG. 62. (*Tyroglyphus Mycophagus*).
FIG. 63. Cheese Mite (*Tyroglyphus siro*).
FIG. 64. (*Tyroglyphus malus*).
FIG. 65. Itch Mite (*Sarcoptes scabei*), male.
FIG. 66. Itch Mite (*Sarcoptes scabei*), female in channel of human skin.
FIG. 67. Wood Ant (*Formica rufa*), female.
FIG. 68. Leaf-cutting Ant (*Eciton drephanophora*), neuter.
FIG. 69. Worker Major (*Ectatomma ferruginea*).
FIG. 70. Worker Minor (*Formica fulvacea*).
FIG. 71. Worker Major (*Polyrhaceis arboricola*).
FIG. 72. Worker Minor (*Eciton mexicana*).
FIG. 73. Worker Minor (*Eciton sumichrasti*).
FIG. 74. Mexican Honey-ant (*Myrmecocystus mexicanus*).

1881.—REPORT XII.

FIG. 1. Satellite Sphinx (*Philampelus satellitia*, Linn.).
FIG. 2. Satellite Sphinx (*Philampelus satellitia*, Linn.), larva.
FIG. 3. Indian Cetonia (*Euryomia Inda*, Linn.).

FIG. 4. Legged Maple-borer (*Ægeria acerni*, Clemens).
FIG. 5. Red-humped Apple-tree Caterpillar (*Notodonta concinna*).
FIG. 6. Red-humped Apple-tree Caterpillar (*Notodonta concinna*), larva.
FIG. 7. Red-humped Apple-tree Caterpillar (*Notodonta concinna*), pupa.
FIG. 8. Eyed Elater (*Alaus occulatus*).
FIG. 9. Stag Beetle (*Lucanus dama*).
FIG. 10. Asparagus Beetle (*Crioceris asparagi*, Linn.).
FIG. 11. Onion Fly (*Anthomyia ceparum*, Bouche).
FIG. 12. Clover-seed Midge (*Cecidomyia leguminicola*, Lint), larva.
FIG. 13. Clover-seed Midge (*Cecidomyia leguminicola*, Lint), fly, female.
FIG. 14. Clover-seed Midge (*Cecidomyia leguminicola*, Lint), fly, male.
FIG. 15. Clover-root Borer (*Hylastes trifolii*, Muller).
FIG. 16. Clover-stem Borer (*Languria mozardi*).
FIG. 17. Clover-leaf Midge (*Cecidomyia trifolii*).
FIG. 18. Clover-hay Worm (*Asopia costalis*, Fabr.).
FIG. 19. Clover Drasteria (*Drasteria erichtea*, Cramer).
FIG. 20. Clouded Sulphur-butterfly (*Colias philodice*, Godt.), male.
FIG. 21. Clouded Sulphur-butterfly (*Colias philodice*, Godt.), female.
FIG. 22. Abbot Sphinx (*Thyreus Abbotii*, Swainson).
FIG. 23. (*Deilephila chamænerii*, Harris).
FIG. 24. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.), larva.
FIG. 25. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.), larva, black variety.
FIG. 26. White-lined Morning-sphinx (*Deilephila lineata*, Fabr.), moth.
FIG. 27. Green Grape-vine Caterpillar (*Darapsa myron*, Cramer), larva.
FIG. 28. Green Grape-vine Caterpillar (*Darapsa myron*, Cramer), parasite on larva.
FIG. 29. Green Grape-vine Caterpillar (*Darapsa myron*, Cramer), larva with parasite.
FIG. 30. Green Grape-vine Caterpillar (*Darapsa myron*, Cramer), cocoon.
FIG. 31. Green Grape-vine Caterpillar (*Darapsa myron*, Cramer), moth.
FIG. 32. Satellite Sphinx (*Philampelus pandorus*, Hubner).
FIG. 33. Satellite Sphinx (*Philampelus pandorus*, Hubner), larva.
FIG. 34. Achemon Sphinx (*Philampelus achemon*, Drury), larva.
FIG. 35. Achemon Sphinx (*Philampelus achemon*, Drury), pupa.
FIG. 36. Achemon Sphinx (*Philampelus achemon*, Drury), moth.
FIG. 37. Tomato Worm (*Sphinx quinque-maculata*, Haworth.
FIG. 38. Plum Sphinx (*Sphinx Drupiferarum*, Sm. and Abb.), larva.
FIG. 39. Plum Sphinx (*Sphinx Drupiferarum*, Sm. and Abb.), pupa.
FIG. 40. Plum Sphinx (*Sphinx Drupiferarum*, Sm. and Abb.), moth.
FIG. 41. Burying Beetle (*Necrophorus velutinus*).
FIG. 42. Woolly Aphis of the Apple (*Schizoneura lanigera*, Hausm), on twigs.
FIG. 43. Woolly Aphis of the Apple (*Schizoneura lanigera*, Hausm), on root.
FIG. 44. Codling Moth (*Carpocapsa pomonella*, Linn.).
FIG. 45. Oyster-shell Bark-louse (*Mytilaspis pomicorticis*, Riley).
FIG. 46. Oyster-shell Bark-louse (*Mytilaspis pomicorticis*, Riley), infested twig.
FIG. 47. Gooseberry Saw-fly (*Nematus ribesii*, Curtis), leaf with eggs.
FIG. 48. Gooseberry Saw-fly (*Nematus ribesii*, Curtis), larva.
FIG. 49. Gooseberry Saw-fly (*Nematus ribesii*, Curtis), fly.
FIG. 50. Pear-tree Slug-worm (*Selandria cerasi*, Curtis).
FIG. 51. Gooseberry Magpie-moth (*Abraxas grossulariata*, Stephens), larva and pupa.
FIG. 52. Gooseberry Magpie-moth (*Abraxas grossulariata*, Stephens), moth.

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FIG. 1. Southern Cabbage-butterfly (*Pieris protodice*, Boisd), male.
FIG. 2. Southern Cabbage-butterfly (*Pieris protodice*, Boisd), female.
FIG. 3. Southern Cabbage-butterfly (*Pieris protodice*, Boisd), larva.
FIG. 4. (*Ecpantheria scribonia*, Hubner), larva.
FIG. 5. (*Ecpantheria scribonia*, Hubner), moth.
FIG. 6. American Silk-worm (*Telea polyphemus*, Linn.), larva.
FIG. 7. American Silk-worm (*Telea polyphemus*, Linn.), cocoon.
FIG. 8. American Silk-worm (*Telea polyphemus*, Linn.), pupa.
FIG. 9. American Silk-worm (*Telea polyphemus*, Linn.), male moth.
FIG. 10. American Silk-worm (*Telea polyphemus*, Linn.), female moth.
FIG. 11. Long-tailed Ophion (*Ophion macrurum*, Linn.).
FIG. 12. Apply Fly (*Drysophila ampelophila*).
FIG. 13. Apple Fly (*Drysophila ampelophila*), larva and pupa.
FIG. 14. Luna Moth (*Actias luna*, Linn.).
FIG. 15. Luna Moth (*Actias luna*, Linn.), larva.
FIG. 16. West Indian Fire-fly (*Pyrophorus noctilucus*).
FIG. 17. Mosquito (*Culex pipiens*, Linn.).
FIG. 18. Mosquito (*Culex pipiens*, Linn.), mouth of.
FIG. 19. Wheat-midge (*Cecidomyia tritici*, Kirby),
FIG. 20. Wheat-midge (*Cecidomyia tritici*, Kirby), wings folded.
FIG. 21. Wheat-midge (*Cecidomyia tritici*, Kirby), eggs.
FIG. 22. Wheat-midge (*Cecidomyia tritici*, Kirby), larva.
FIG. 23. Wheat-midge (*Cecidomyia tritici*, Kirby), kernel of wheat affected by.
FIG. 24. Hessian-fly (*Cecidomyia destructor*, Say).
FIG. 25. Clover-leaf Midge (*Cecidomyia trifolii*).
FIG. 26. Clover-seed Midge (*Cecidomyia leguminicola*, Linn.), larva.
FIG. 27. Clover-seed Midge (*Cecidomyia leguminicola*, Linn.), female fly.
FIG. 28. Clover-seed Midge (*Cecidomyia leguminicola*, Linn.), male fly.
FIG. 29. Gall-fly (*Cecidomyia strobiloides*, O. S.).
FIG. 30. Grape-vine Apple-gall (*Vitis pomum*, W. and R.).
FIG. 31. Grape-vine Filbert-gall (*Vitis coryloides*, W. and R.).
FIG. 32. Grape-leaf Trumpet-gall (*Vitis viticola*, O. S.).
FIG. 33. Grape-vine Tomato-gall (*Vitis tomatos*, O. S.): (*Lasioptera vitis*, O. S.).
FIG. 34. Resin-inhabiting Diplosis (*Diplosis resincola*, O. S.).
FIG. 35. Horse-fly (*Tabanus atratus*, Fabr.).
FIG. 36. Bee-killer (*Trupanea apivora*, Fitch).
FIG. 37. *Syrphus-fly*, Sp.
FIG. 38. *Syrphus-fly*, Sp., larva.
FIG. 39. Root-louse Syrphus-fly (*Pipiza radicans*, W. and R.).
FIG. 40. Horse Breeze-fly (*Œstrus equi*, Fabr.), male.
FIG. 41. Horse Breeze-fly (*Œstrus equi*, Fabr.), female.
FIG. 42. Horse Breeze-fly (*Œstrus equi*, Fabr.), eggs.
FIG. 43. Horse Breeze-fly (*Œstrus equi*, Fabr.), larva.
FIG. 44. Ox Bot-fly (*Œstrus bovis*, Latr.).
FIG. 45. Ox Bot-fly (*Œstrus bovis*, Latr.), larva.
FIG. 46. Sheep Bot-fly (*Œstrus ovis*, Linn.).
FIG. 47. *Tachina* (?)———
FIG. 48. Red-tailed Tachina-fly (*Exorista leucaniœ*, Kirk).
FIG. 49. Flesh-fly (*Sarcophaga carnaria*, Linn.).
FIG. 50. Flesh-fly (*Sarcophaga carnaria*, Linn.), larva.
FIG. 51. Flesh-fly (*Sarcophaga sarraceniœ*, Riley).
FIG. 52. Anthomyia Egg-parasite (*Anthomyia radicum*, Linn. : var. *Calopteni*, Riley).
FIG. 53. Onion-fly (*Anthomyia ceparum*, Bouche).

Fig. 54. Onion-fly (*Ortalis flexa*, Wied.).
Fig. 55. Tongue of Common House-fly (*Musca domestica*, Linn.).
Fig. 56. Potato-beetle (*Lema trilineata*, Oliv.).
Fig. 57. Potato-beetle (*Lema trilineata*, Oliv.), larva.
Fig. 58. Asparagus-beetle (*Crioceris asparagi*, Linn.).
Fig. 59. Dominican Case-bearer (*Cascinoptera dominicana*, Fabr.).
Fig. 60. (*Chlamys plicata*, Oliv.).
Fig. 61. Grape-vine Fidia (*Fidia viticida*, Walsh).
Fig. 62. Grape-vine Colaspis (*Colaspis flavida*, Say), larva.
Fig. 63. Grape-vine Colaspis (*Colaspis flavida*, Say), beetle.
Fig. 64. Spined Soldier-bug (*Arma spinosa*, Dallas).
Fig. 65. The Belted Soldier-bug (*Perillus circumcinctus*, Say).
Fig. 66. The Many-banded Robber-bug (*Harpactor cinctus*, Fabr.).
Fig. 67. Great Lebia (*Lebia grandis*, Hentz).
Fig. 68. Fifteen-spotted Mysia (*Mysia 15-punctata*, Oliv.)
Fig. 69. Colorado Potato-beetle (*Doryphora 10-lineata*, Say).
Fig. 70. Striped Cucumber-beetle (*Diabrotica vittata*, Fabr.).
Fig. 71. Twelve-spotted Diabrotica (*Diabrotica 12-punctata*, Oliv.).
Fig. 72. Grape-vine Flea-beetle (*Haltica chalybea*, Illig.).
Fig. 73. Striped-turnip Flea-beetle (*Haltica striolata*, Fabr.).
Fig. 74. Cucumber Flea-beetle (*Haltica cucumeris*, Harris).
Fig. 75. Grape-vine Phylloxera (*Phylloxera vastatrix*, Planchon); type, *Gallæcola*, or Gall-inhabiting; leaf with galls.
Fig. 76. Grape-vine Phylloxera (*Phylloxera vastatrix*, Planchon); type, *Gallæcola*, or louse.
Fig. 77. Grape-vine Phylloxera (*Phylloxera vastatrix*, Planchon); type, *Radicola* or Root-inhabiting; different stages.
Fig. 78. Grape-vine Phylloxera (*Phylloxera vastatrix*, Planchon); type, *Radicola* or Root-inhabiting; enlarged.
Fig. 79. Root-louse Syrphus-fly (*Pipiza radicans*, W. and R.).
Fig. 80. Phylloxera Mite (*Tyroglyphus phylloxeræ*, Planchon and Riley), dorsal and ventral view.
Fig. 81. (*Hoplophora arctata*, Riley).
Fig. 82. Grape Berry-moth (*Lobesia botrana*, Packard).
Fig. 83. Chinch-bug (*Micropus leucopterus*, Say).
Fig. 84. Seventeen-year Locust (*Cicada septemdecim*, Linn.).
Fig. 85. Seventeen-year Locust (*Cicada septemdecim*, Linn.); chambers of Cicada.
Fig. 86. Seventeen-year Locust (*Cicada septemdecim*, Linn.); young Cicada.
Fig. 87. Seventeen-year Locust (*Cicada septemdecim*, Linn.); winged Cicada.
Fig. 88. Grape Thrip (*Tettigonia vitis*, Harris).
Fig. 89. Large-winged Psylla (*Psylla*, Sp.).
Fig. 90. Apple Aphis (*Alphis mali*, Fabr.).
Fig. 91. Oyster-shell Bark-louse (*Aspidiotus conchiformis*, Gmélin).

PART II.—CLASSIFIED LIST OF INSECTS ILLUSTRATED.

The following list has been prepared in order to enable any one to ascertain whether any particular insect belonging to any specified order, has been figured in the Reports. The nomenclature of the Reports is retained.

The number of the Report is indicated in Roman, and of the Figure, in Arabic numerals.

HYMENOPTERA.

Chalcis mariæ *Riley;* V., 23.
Chlorion cyaneum *Dahlb;* XI., 44.
Cryptus nuncius *Say;* V.; 24.
Emphytus maculatus *Norton;* III., 14 : IV., 12.
Eciton drephanophora : XI., 68.
Eciton mexicana : XI., 72.
Eciton sumichrasti : XI., 73.
Ectatomma ferruginea : XI., 69.
Formica rufa : XI., 67.
Formica fulvacea : XI., 70.
Isosoma vitis *Saunders;* I, 48, 49.
Isosoma hordei *Harr.;* II., 58, 59, 60 ; III., 6, 7.
Megachile brevis *Say;* II., 22.
Macrocentrus delicatus *Cresson;* V., 39 ; VII., 13 ; XI., 51.
Microgaster species : I., 35, 36 ; III., 54.
Myrmeococystus mexicanus : XI., 74.
Nematus ventricosus *Klug;* II., 26, 27, 28; V., 7, 8, 9 ; VI., 14 ; VIII., 26, 27, 28 ; XI., 52.
Nematus ribesii *Curtis;* XI., 29 ; XII., 47, 48, 49.
Ophion macrurum *Linn.;* V., 20, 21 ; VI., 29 ; XIII., 11.
Osmia Canadensis *Cresson;* III., 15.
Pimpla annulipes *Br.;* V., 38 ; VII., 12.
Porizon conotracheli *Riley;* VII., 16 ; X., 57.
Polyrhacis arboricola : XI., 71.
Pristiphora grossulariæ *Walsh;* II., 30 ; III., 53.
Selandria cerasi *Peck;* XI., 28 ; XII., 50.
Sigalphus curculionis *Fitch;* VII., 14, 15 ; X., 56.

COLEOPTERA.

Anthonomus quadrigibbus *Say;* I., 23 ; XI., 31.
Anthonomus prunicida *Walsh;* XI., 37.
Agriotes mancus *Say;* II., 64 ; X., 53, 54.
Agrilus ruficollis *Fabr.;* IV., 2, 3, 4 ; IX., 37.
Alaus occulatus *Linn.;* X., 52 ; XI., 25 ; XII., 8.
Anthrenus scrophulariæ : IX., 14 ; X., 1.
Brachinus fumans *Linn.;* III., 75 ; IX., 27.
Bruchus pisi *Linn.;* X., 31 ; XI., 32.
Bruchus fabæ *Riley;* XI., 33.
Baridius trinotatus *Say;* XI., 43.
Calosoma scrutator *Fabr.;* I., 22 ; III., 70 ; VI., 6 ; IX., 23 ; XI., 2.
Calosoma calidum *Fabr.;* II., 75 ; III., 71 ; VI., 5 ; IX., 22 ; XI., 1.
Cicindela vulgaris *Say;* III., 66 ; IX., 16 ; XI., 9.
Cicindela purpurea *Riv.;* III., 67 ; IX., 17 ; XI., 5.
Cicindela hirticollis *Say;* III., 68 ; IX., 18 ; XI., 7.
Cicindela generosa *Dejean;* III., 69 ; IX., 20 ; XI., 8.
Cicindela sexguttata *Fabr.;* IX., 19 ; XI., 6.
Chrysobothris femorata *Say;* I., 3 ; III., 76 ; V., 5, 6 ; VIII., 5, 12.
Chilocorus bivulnerus *Muls.;* I., 8, 9 ; III., 81 ; VIII., 15, 16 ; IX., 34.
Chlamys plicata *Oliv.;* XIII., 60.
Coccinella novemnotata *Herbst;* I., 14 ; II., 53, 71 ; III., 18, 83 ; VIII., 8, 9 ; IX., 28.
Coccinella munda *Say;* II., 50 ; VIII., 12 ; IX., 29.
Coccinella 13-punctata *Linn.;* II., 72.
Cantharis vesicatoria *Linn.;* VII., 9.
Cantharis vulnerata *Linn.;* VII., 10.
Cantharis nutalli *Say;* VII., 11.
Chauliognathus pennsylvanicus *DeGeer;* I., 56.
Clytus speciosus *Say;* III., 26 ; VIII., 2 ; IX., 13 ; XI., 13.
Clytus robiniæ *Forst;* VIII., 4.
Conotrachelus nenuphar, *Herbst;* I., 53 ; II., 23 ; III., 78 : VIII., 35 ; X., 55 ; XI., 36.
Conotrachelus cratægi *Walsh;* XI., 40.
Cotalpa lanigera *Linn.;* X., 36.
Coscinopteris dominicana *Fabr.;* XIII., 59.
Colaspis flavida *Say;* XIII., 62, 63.
Crioceris asparagi *Linn.;* XI., 30 ; XII., 10 ; XIII., 58.
Cysteodemus armatus *Lec;* VII., 2.
Diabrotica vittata *Fabr.;* II., 66, 101, 102, 103 ; III., 80 ; IX., 7, 8, 9 ; XIII., 70.
Diabrotica 12-punctata *Fabr.;* II., 100 ; XIII., 71.
Dermestes lardarius *Linn.;* IV., 19 ; IX., 1.
Doryphora decem-lineata *Say;* II., 68 ; III., 36 ; VI., 16 ; XIII., 69.
Dytiscus Harrisii : X., 38.
Epicœrus imbricatus *Say;* XI., 41.
Epicauta vittata, *Fabr.;* II., 81, III., 77 ; VII., 7.
Epicauta cinerea *Fabr.;* II., 82 ; VII., 8.
Epicauta murina *Lec.;* II., 82.
Euryomia inda *Linn.;* X., 37 ; XI., 3 ; XII., 3.
Fidia viticida *Walsh;* XIII., 61.
Haltica chalybea *Illiger;* I., 46, 47 ; II., 14 ; VIII., 32, 33 ; XIII., 72.

Haltica cucumeris *Harris;* II., 104; XIII., 73.
Haltica nemorum *Linn.;* XI., 21.
Haltica striolata *Fabr.;* XIII., 73.
Harpalus caliginosus *Say;* II., 76; III., 50, 72; IX., 24.
Harpalus pennsylvanicus *DeGeer;* I, 54, 55; II., 77; III., 73, 74; IX., 25, 26.
Hippodamia maculata *DeGeer;* II., 49, 70; III., 82; VIII., 10; IX., 30.
Hippodamia 13-punctata *Linn.;* VII., 11; IX., 31.
Hippodamia convergens *Guen.;* II., 73; III., 84; VIII., 13; IX., 32.
Hydrophilus triangularis: X., 39.
Hylastus trifolii *Muller;* XII., 15.
Lachnosterna quercina *Knoch;* III., 8; X., 33.
Languria mozardi: XII., 16.
Lebia grandis *Hentz;* XIII., 67.
Lema trilineata *Oliv.;* II., 65, 67; XIII., 56, 57.
Lucanus dama *Fabr.;* X., 32; XII., 9.
Macrodactylus subspinosus *Fabr.;* III., 1; X., 34.
Macrobasis albida *Say;* VII., 4.
Macrobasis atrivittata *Lec.;* VII., 5.
Macrobasis segmentata *Say;* VII., 6.
Meloe angusticollis *Say;* VII., 1.
Meloe larva: VII., 1.
Monohammus confusor *Kirby;* VIII., 7.
Monohammus scutellatus *Say;* VIII., 1.
Mylabris cichorii *Linn.;* VII., 3.
Mysia 15-punctata *Oliv.;* II., 74; III., 37; VIII., 14; IX., 33; XIII., 68.
Necrophorus velutinus: XII., 41.
Oberea tripunctata *Fabr;* VIII., 8.
Orthosoma cylindricum *Fabr.;* VI., 22, 23; VIII., 3, pl.; Fig. 1; XI., 47.
Pelidnota punctata *Linn;* I., 45; II., 13; III., 61 VIII., 31; X., 35.
Phyllophaga quercina *Knoch;* VIII., 30.
Psenocerus supernotatus *Say;* X., 49.
Pissodes strobi *Peck:* XI., 35.
Pyrophorus noctilucus: X., 51; XIII., 16.
Pyrota mylabrina *Cheo.;* VII., 12.
Saperda bivittata *Say;* I., 2.
Saperda candida *Fabr.;* VIII., 6, pl.; Fig. 3.
Sphenophorus Zeæ *Walsh;* XI., 42.
Stenocerus putator *Peck;* S. villosus *Fabr.;* I., 10, 11, 12; III., 79.
Tegrodera erosa *Lec.;* VII., 13.
Tyloderma fragariæ; XI., 38.

LEPIDOPTERA.

Colias philodice *Godt.;* V., 25, 26; XII., 20, 21.
Danais Archippus *Fabr.;* III., 39, 40, 41, 42, 43; XI., 12, 14.
Grapta interrogationis, *Godt.;* III., 24.
Grapta progne *Cram.;* II., 33.
Libythea Bachmani *Kirkland;* XI., 15.
Limenitis disippus *Godt.;* III., 44, 45, 46.
Papilio asterias *Cram.;* VII., 8.
Papilio cresphontes *Cram.;* IX., 38, XI., 19.
Papilio philenor *Fabr.;* XI., 16, 17, 18.
Papilio turnus *Linn.;* IV., 13, 14; X., 40, 41.
Pieris oleracea *Harris;* casta, *Kirby;* II., 87, 88; III., 58.
Pieris protodice, *Boisd;* II., 89, 90, 91; III., 55; XIII., 1, 2, 3.
Pieris rapæ *Linn.;* II., 84, 85, 86; VI., 9, 10, 11; XI., 23, 24.
Abraxas grossulataria *Stephens;* XII., 51, 52.
Actias luna *Linn.;* VII., 3; XIII., 14, 15.
Agrotis devastator *Brace;* X., 2.
Agrotis cochranii *Riley;* X., 5.
Agrotis clandestina *Harris;* X., 6.
Agrotis messoria *Harris;* X., 5.
Agrotis subgothica *Haworth;* X., 4.
Agrotis telifera *Harris;* X., 3.
Acronycta psi *Linn.;* I., 60; II., 24.
Acronycta oblinita *Sm. & Abb.;* III., 13.
Ægeria tipuliformis *Linn.;* II., 39; VIII., 25; X., 50.
Ægeria cucurbitæ *Harris;* II., 96, 97, 98.
Ægeria acerni *Clemens;* XII., 4.
Anisopteryx vernata *Peck;* I., 28; VI., 1, 2.
Anisopteryx pometaria *Harris;* VI., 3, 4.
Amphipyra pyramidoides *Guen.;* II., 17, 18.
Angerona crocaotaria *Guen.;* II., 34, 35; III., 12.
Anchylopera fragariæ *Riley;* III., 9.
Aplodes rubivora, *Riley;* IV., 10.
Arctia Saundersii *Grote;* IV., 16.
Asopia costalis *Fabr.;* XII., 18.
Catocala ultronia *Hubner;* X., 45.
Carpocapsa pomonella *Linn.;* I., 30; II., 7; VIII., 34; XII., 44.
Chærocampa pampinatrix *Sm. & Abb.;* I., 34, 37, 38; II., 8, 9; III., 56.
Cidaria diversilineata *Hubner;* I., 43.
Clisiocampa Americana *Harris;* I., 18; VI., 7; VIII., 21, 22, 23.
Clisiocampa Sylvatica *Harris;* I., 19; VI., 8; VIII., 24; IX., 5. 6.
Datana ministra *Drury;* I., 26.
Desmia maculalis *Westwood;* I., 41; II., 10.
Dryocampa rubicunda *Fabr.;* III., 27.
Deilephila lineata *Fabr.;* V., 27, 28, 29; VII., 5, 6, 7; XII., 24, 25, 26.
Deilephila chamænerii *Harris;* VII., 4; XII., 23.
Deiopeia bella *Drury;* VI., 17.
Drasteria erecthea *Cram.;* VI., 18; XII., 19.
Darapsa myron *Cram.;* XII., 27, 28, 29, 30, 31.
Ecpantheria scribonia *Hubner;* XIII., 4, 5.
Eudryas grata *Fabr.;* I., 35; VI., 19, 20.
Ellopia ribearia *Fitch;* II., 31, 32; V., 12, 13; VI., 15.
Grapholitha oculana: I., 61; II., 25.
Galleria cereana *Fabr.;* VII., 10.
Hyphantria textor *Harris;* II., 6; IV., 7.
Hypena humuli *Harris;* III., 23.
Lobesia vitivorana *Pack;* XIII., 82.
Leucania unipuncta *Haworth;* II., 61, 62, 63; III., 57; XI., 52, 53.
Lozotænia rosaceana *Harris;* II., 37, 38; III., 10, 11; IV., 8, 9.

Macrosila quinquemaculata *Hawthorn*; II., 83; XI., 10.
Mamestra picta *Harris*; II., 92.
Notodonta concinna *Sm. & Abb.*; I., 27; XII., 5, 6, 7.
Orgyia leucostigma *Sm. & Abb.*; I., 23, 24, 25; II., 3, 4, 5; V., 14, 15, 16.
Pempelia grossulariæ *Packard*; II., 40; VII., 9; VIII., 29.
Philampelus satellitia *Linn.*; XII., 1, 2.
Philampelus pandorus *Hubner*; XII., 32, 33.
Philampelus achemon *Drury*; III., 2, 3, 4; X., 42, 43, 44; XII., 34, 35, 36.
Plusia brassicæ *Riley*; II., 93.
Plusia balluca *Geyer*; III., 25.
Pterophorus periscelidactylus *Fitch*; I., 42; II., 11.
Pryocyla armataria *Herr. Sch.*; II., 36.
Pyrrharctia Isabella *Sm.*; IV., 15; VIII., 36.
Samia Cecropia *Linn*; I., 29, 30, 31; III., 33; V., 17, 18, 19.
Saturnia (hyperchiria) Io *Fabr.*; V., 1, 2, 3, 4; X., 46, 47, 48.
Sphinx drupiferarum *Sm. & Abb.*; II., 19, 20, 21; III., 52; XII., 38, 39, 40.
Spilosoma virginica *Fabr.*; I., 44; II., 12; XI., 3.
Sphinx quinquemaculata *Haworth*; XII., 37.
Telea polyphemus *Linn.*; III., 28, 29, 30, 31, 32; VI., 24, 25, 26, 27, 28; XIII., 6, 7, 8, 9, 10.
Tinea flavifrontella *Linn.*; VI., 20, 21.
Thyreus Abbotii *Swainson*; III., 5; XI., 20; XII., 22.

HETEROPTERA.

Arma spinosa *Dallas*; II., 78; III., 51; XIII., 64.
Belostoma grandis *Linn.*; IV., 17; XI., 48.
Corimelæna pulicaria *Germ.*; IV., 11.
Coreus tristis *DeGeer*; II., 69; III., 63; IX., 10.
Micropus leucopterus *Say*; II., 47, 48; XIII., 83.
Podiscus placidus *Uhler*; II., 29.
Perillus circumcinctus *Stal.*; II., 80; III., 38.
Reduvius raptatorius *Say*; II., 79.
Strachia histrionica *Harris*; II., 94, 95; III., 62.

HOMOPTERA.

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